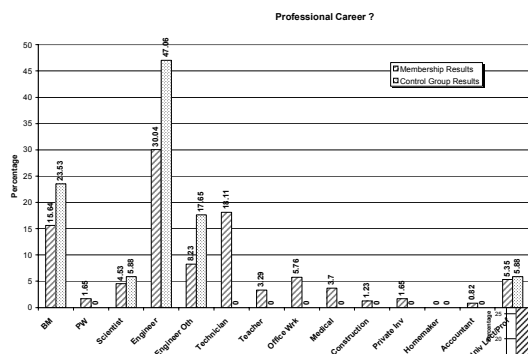


## Board of Directors Election Results - see page 15

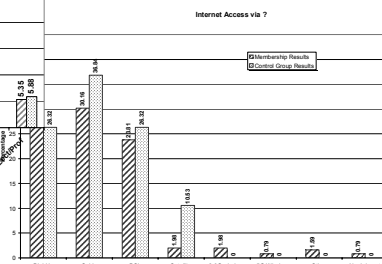
Young Canadian ham and her father work together to land satellite contacts.



The results of the membership profile poll are in.



See all the membership statistics you could ever want!



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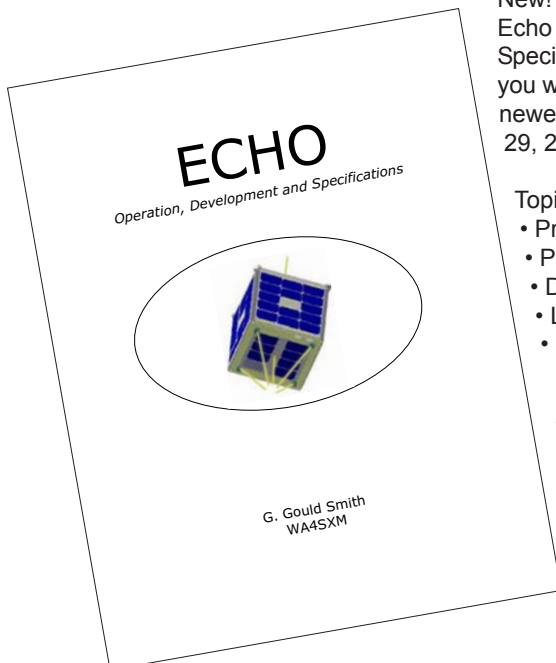
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### AMSAT's Mission

AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow Amateur Radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

### AMSAT's Vision

Our Vision is to deploy high earth orbit satellite systems that offer daily coverage by 2009 and continuous coverage by 2012. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups.







Radio Amateur Satellite Corporation (AMSAT-NA)  
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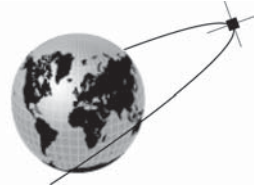
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## APOGEE VIEW

by Robin Haighton, VE3FRH • [ve3frh@amsat.org](mailto:ve3frh@amsat.org)



After four years as your President, the time has come for me to retire from this position and to hand over the reins of AMSAT leadership to another person with new ideas. The past four years have been a challenge, with the economy of the US being slow and such incidents as the reduced hopes for AO-40, 9/11, Enron, WorldCom, Arthur Andersen and SARS. All these things affected AMSAT and the ability of our organization to raise funds to build satellites.

However, the Board of Directors sensing the problem quite early, decided to reduce our expectations on Eagle and to build Echo, at a lower cost and within our capability to raise the necessary funding. As you are now aware that mission has been accomplished with your considerable help. Echo is working well and although we are still in the commissioning phase (at the time of writing), I am confident that this bird will live up to its earlier billing. The Experimenter's Wednesdays are a success and it would seem that the SQRX receiver, the 2.4GHz transmitter and all on board equipment is functional. There is only one flaw: operators who use high power to get into the satellite. I ask you to "back off your power – use no more than 5 watts as uplink power from your transmitter, leave any gain after that to your antenna system".

Now to the future, the Board of Directors will meet on October 7<sup>th</sup> to choose your next president. That person will, I am sure, take a different approach to AMSAT than that of the past four years, and rightly so. Please give the new President your support and work with him and the Board to develop Eagle to provide both the services that you want and the digital services that may become the future of Amateur Radio. We do not want another fight over mode of operation as we had with AM vs. SSB many years ago. We really do need to have both our standard (SSB) transponders and also the new digital modes.

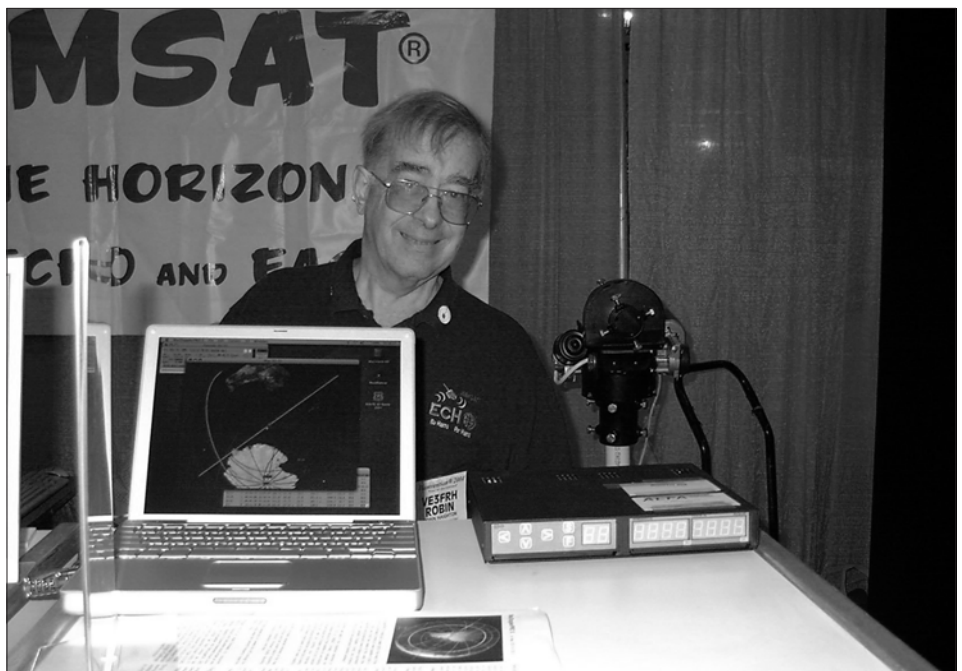
Talking of these modes, take a detailed look at Tom Clark's CC Rider article in the July/August issue of *The AMSAT Journal* and also the member survey article in this issue. Also review the P3E article in the previous issue with particular reference to the U/V module.

I anticipate continuing as a Board member for a while and I particularly hope to represent the membership who has supported AMSAT so well in the past.

73,

Robin Haighton, VE3FRH

President AMSAT (at the time of writing) ☺



Robin, VE3FRH, outgoing AMSAT President, at the Dayton Hamvention May 2004.  
Photo by WA4SWJ.



## What is AMSAT®?

AMSAT members are a worldwide group of enthusiastic individuals designing, building and operating Amateur Radio satellites as part of our program of space science education.

The Radio Amateur Satellite Corporation (AMSAT or AMSAT-NA) is a non-profit scientific and educational organization chartered in Washington, DC, in 1969. Since then, AMSAT and colleague organizations around the world have built over 50 ham radio satellites. Fifteen of these satellites continue in operation.

Joining AMSAT supports our current projects: Eagle, AMSAT-OSCAR-E (Echo) and ARISS. Eagle is a high orbit DX capable satellite planned for a 2007 launch. Echo is a low orbit FM and digital bird you will be able to use with simple equipment, planned for launch in 2004. And ARISS is our program on the International Space Station. You will keep up to date on the world of Amateur Radio satellites with 6 issues of the AMSAT Journal every year.



## We'd like to have you as a member!

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**TOTAL Membership Renewal and Donations in US \$** \_\_\_\_\_

**D**o you send QSL cards for satellite contacts? You can help AMSAT by inserting the form above describing AMSAT and providing membership information when you send your QSL's. Put one of these inserts in with every QSL mailing and will help other hams find out about AMSAT and you will help AMSAT build new satellites by helping to add new members.

Included at the amsat.org Web site are forms for single sided printing ... just print, cut, fold and mail. You can also find forms for double sided printing if you prefer.

You can find the AMSAT QSL inserts online at:

<http://www.amsat.org/amsat/amsat-na/membership.html>

**Rick Hambly (right), W2GPS, AMSAT Executive VP, is shown viewing the AMSAT QSL Insert. Add one to your QSL's and encourage your fellow hams to join AMSAT.**





**University of Toronto Institute for Aerospace Studies**  
4925 Dufferin Street, Toronto, Ontario, Canada, M3H 5T6

From the Office of the Managing Director, Dr. R. E. Zee

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30 June 2004

Mr. F. Robin Haighton, VE3FRH  
President  
Radio Amateur Satellite Corporation (AMSAT-NA)  
850 Sligo Avenue  
Silver Spring, MD  
USA 20910-4703

Dear Mr. Haighton:

I write this letter in grateful acknowledgment of AMSAT's contribution to the success of the Microvariability and Oscillations of STars (MOST) microsatellite. Canada's first space telescope and first home-built space science satellite in over 30 years was launched on this day one year ago. Since then the satellite has been commissioned and has been outperforming all expectations. The satellite pointing accuracy is currently three arcseconds, almost an order of magnitude better than the mission requirement of 25 arcseconds. We are also able to collect several times the amount data that was originally planned as a result of having successfully networked ground stations in Toronto, Vancouver and Vienna. Telemetry from MOST continues to come in loud and clear. Scientific discoveries have been announced, and an article in Nature magazine will be published tomorrow on Canada Day, 1 July 2004.

Although this is a time to take great pride in our Canadian accomplishment, we are humbled by the fact that this success would not have been possible had it not been for the contributions of many individuals and organizations. In addition to our funding partners, including Dynacon Incorporated, the Ontario Research and Development Challenge Fund, and Ontario Centers of Excellence Inc. (CRESTech Division), the Radio Amateur Satellite Corporation (AMSAT-NA) played a vital role in the education and mentoring of our staff. Throughout the MOST project, we found the advice of AMSAT engineers to be extremely valuable in helping us to make insightful decisions along the way. To this day we continue to adhere to the lessons and philosophy taught to us by AMSAT.

AMSAT has helped establish a unique program in Canada and we are privileged to be its guardians. We continue to strive for excellence and pursue new opportunities within Canada's space program. In 2001, we initiated the Canadian Advanced Nanospace eXperiment (CanX) program giving teams of students the opportunity to develop and launch their own nanosatellites in less than two years, the time it takes to complete a graduate degree. Amateur radio operators were extremely helpful in the commissioning efforts for CanX-1, our first student satellite. We are actively passing on what we have learned from AMSAT and are training new generations of amateur radio operators. Although the funding environment remains challenging, we are hopeful that AMSAT's beacon will continue to guide and inspire us in our native service to Canadians. We look forward to an ongoing relationship with AMSAT and hope that we will have the chance to work together again soon. I congratulate AMSAT on its accomplishment in Canada.

In Sincere Gratitude,

Robert E. Zee, VE3REZ  
Managing Director, Space Flight Laboratory  
University of Toronto Institute for Aerospace Studies





## AMSAT Membership Profile 2004

by Gunther Meisse, W8GSM  
AMSAT Treasurer

Over the years there has been much discussion on many aspects of AMSAT North America and what our members really think as well as just what the characteristics of our membership are. When deciding to run for the Board of Directors in 2003, I pledged to plan and oversee a Membership Profile Survey so that we could develop some definitive answers to many of these questions.

This project was designed to provide the Board of Directors of AMSAT North America with a comprehensive membership Fact and Opinion set for planning purposes during the next few years. It was felt that it would be useful for the Board members and senior advisors to be able to compare their personal views with those of the *General Membership* and the other policy makers of our organization. To that end, we created a *Control Group* comprised of these highly involved people. Their views are illustrated alongside the responses of the *General Membership* on each results graph. No conclusion is drawn by these comparative displays. They were simply intended to be a "reality-check" and planning tool for the present and future boards. This Membership Profile is also a needed tool for the creation of a good "Case for Support" which we will write this fall and winter, intended to show the nature of AMSAT and our work, for the benefit of outsiders, including exterior fundraising sources.

If you have ever wondered if your involvement of time and money in AMSAT made a difference, or if AMSAT really did count in the world of our members, and Amateur Radio in general, please read carefully the letter we received in response to our profile participation solicitation letter (Figure 1). It will dispel any such disbelief.

### AMSAT Membership Profile 2004 Methodology

Two data groups were created for this study: *General Membership* (shown as Membership Results) and *Control Group*. The *General Membership* comprises all members of AMSAT-NA, as of December, 2003 including: all Life Members, USA Current Members, Canadian Current Members and Foreign Current Members. This database totaled 3888 records. From this database 389 (10%) names were randomly selected for solicitation for participation in the study. While a sample of ten percent is far more than needed for a statistically reliable sample, we wished to

have 250 in-tab responses to smooth out the waxing and waning that result from small sample sizes.

A three-page questionnaire, including 49 questions and comment space was produced after consultation and circulation to the AMSAT board for input. The questionnaire, a cover letter, a \$2.00 stipend and a return postage paid envelope were sent to each member selected. No AMSAT funds were spent on this project.

The *Control Group* was composed of members of the Board of Directors, the Official Officers, the Departmental officers and advisors. This sample totaled 20. They received the same materials as the general membership. The results were segregated into the two respondent groups for separate tabulation.

The *General Membership* response rate was 54% within the first few weeks. To make the goal of 250 in-tab responses we mailed a postcard reminder to those who failed to respond to the first mailing. From that effort we met our in-tab goal, cutting off input at 252 or 65% return rate.

From the *Control Group* we received one shy of a 100% return.

A specific margin of error has not been produced since "missing cases" would require extensive calculating question by question. In general, it is safe to say that the margin of error is well in the low single digits.

In the interest of brevity for this article I have not done any cross tabulations (Interest/age group, etc.). Specific interests will be cross-tabulated in the future in response to specific Board and membership questions.

The questionnaire was created, tabulated, and analyzed using "Marketing Masters" SurveySaid® software Ver. 11, release 4.

### Fact Set

We look at the responses that show the factual demographics of our membership.

### Age and Gender

As will be no surprise to any of us, AMSAT is 99.01% male.

The age profile is a bit more surprising (Figure 2). It has been suggested that AMSAT was nothing but a bunch of old

April 12, 2004

AMSAT  
850 Sligo Avenue Suite 600  
Silver Spring, MD 20910

Dear AMSAT,

Thank you for your interest in contacting my father about his AMSAT membership. He is a lifetime member and has always been very proud of that fact.

Unfortunately, he was diagnosed with Alzheimer's three years ago. He is no longer able to benefit from his AMSAT membership. The first signs of his Alzheimer's revealed themselves when he began having trouble with his ham radio rig about 5 years ago. He no longer has his rig with him, but he cherishes his AMSAT membership plaque. He no longer knows what it is, but remembers that it was important to him.

I have not had the heart to cancel his membership, but I wanted to let you know what you and the camaraderie of amateur radio operators has meant to him during his life.

You no longer need to send correspondence to my father. He can't read it anymore.

Thank you for your concern and dedication.

Sincerely,

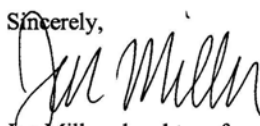
  
Jen Miller, daughter of:  
Wes Miller  
W9LAB

Figure 1



men. As you can see, while we definitely do not fit the national age demographics of America, we in fact, are not quite as “old” as many would have thought. It is important to remember that it would be very unlikely that a hobby such as Amateur Radio satellites would ever fit the general population age distribution since the very young and teens are infrequently exposed to our interests. It is only when one reaches the college level, that there is any exposure to the space sciences. There is little question that we need to work on this issue via more extensive exposure of our hobby to the K-12 age group. It is important to note that 24% of our members are within the 26-49 age group, indicating that we have been successful in attracting younger members.

## Education and Careers

Our educational demographics are far above the national profile, (Figure 3) featuring a real strength in college graduates and post baccalaureate degrees totaling 76 % of our total membership. The *Control Group* makes an even more impressive showing with over 83%.

While the *Control Group* is highly concentrated in the Engineering fields, (Figure 4), the *General Membership* shows a much broader representation of more generalized occupations. Again, this is atypical of the American population profile.

## The Computer and AMSAT Hams

There has been much talk about just how many of our members use computers in their AMSAT hobby and just how connected they are to high-speed resources giving them the capability to receive high graphic content e-mail services and the Internet products.

When asked if they use a computer in their AMSAT ham radio hobby, some 92%, said they did. Of those, how were they connected to their ISP? A total of 61% use some form of high-speed delivery system. (Figure 5)

The *General Membership* connects to their ISP: **39%** by dial-up and **61%** by high speed connections of one description or another. Of the *Control Group*, 72% connect via high-speed. The obvious conclusion is that AMSAT can indeed supply member services that include a higher concentration of graphics while not abandoning the long-standing slow-speed products. When cross-tabulating the dial-up members by age, it would appear that this method (dial-up) is concentrated in the 65+ age groups.

Operating systems among our members are typical with 94% using Windows, 28% DOS, 12% Linux, 7% MacOS. (multiple selections were accepted.)

## AMSAT Membership

When asked the generalized question of how long they had been an AMSAT member (Figure 6), we were pleasantly surprised that we, in fact, do have a good number of relatively new members. The bad news in that regard appears to be that, while we are generating new members, our total membership rolls are not growing substantially, suggesting that we are seeing a substantial membership churn. The *Control Group*, on the other hand, is a much more seasoned group.

## Life Membership

Life Membership is also much more popular among the *Control Group* that boasts **74%** life membership compared to just **24%**

among the *General Membership*. A yet undefined bias exists in this response. The audited count of Life Members within our database is 30%. More detailed study can be done to isolate those respondents and attempt to see what the anomaly is. In any event, Life Memberships appear to have been considerably more popular 15+ years ago (Figure 7). Part of that reality can be attributed to a changing price structure for Life Membership. As you can see, within the last five years there has been virtually no activity.

We asked those members who had been Life Members for **ten years or more** if they would be willing to pay a regular, modest amount, to meet satellite building costs. While **63%** said no, there is some possibility that the **37%** who said yes could be contributors to new AMSAT projects.

## President's Club

Again, the *Control Group* dramatically outpaced the *General Membership*, indicating a **56%** President's Club membership rate, compared to only **8%** within the *General Membership*. Actual auditing of this result indicates that, in fact, some people mistakenly think they are President's Club members, when in fact they are not. Actual President's Club membership only totals 4% of the entire membership. Perhaps there is some confusion by respondents between President's Club and Life Membership, etc.

## Annual Contributions

Not surprisingly, the *Control Group* constitutes a very significant portion of the larger givers. (Figure 8) Nearly one half of the *General Membership* pays nothing more than their annual dues. The “none” basically represents Life Members.

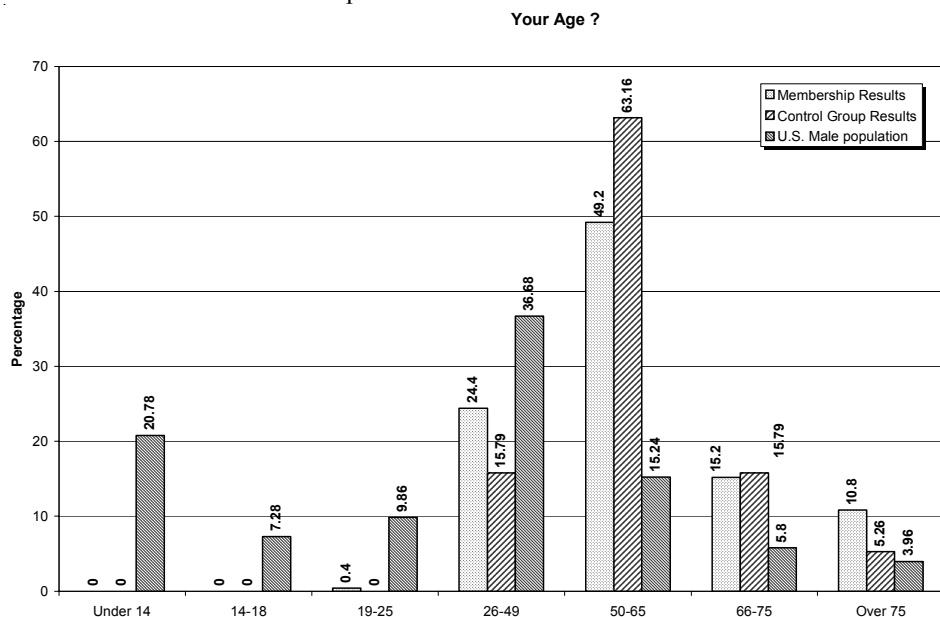
## Member Services

### Bulletin Board Service (AMSAT-bb)

Only **31%** of the *General Membership* report that they subscribe to this service (Figure 9). That would translate to about 1200 actual members who are subscribers. Given the subscription count of 1524 it would appear that nearly all subscribers are members. Again, the highly involved *Control Group* indicates a 61% subscription rate.

### AMSAT Journal

This is a winner!!! The *Journal* is the most consistently favorably reported issue or item in our study (Figure 10). Ninety nine and ½ percent of our respondents report that they read the *Journal* to varying degrees. Only one half of one percent does not read it. These high numbers suggest that if we do



**Figure 2**  
**Membership age distribution**



Education Achievement Level ?

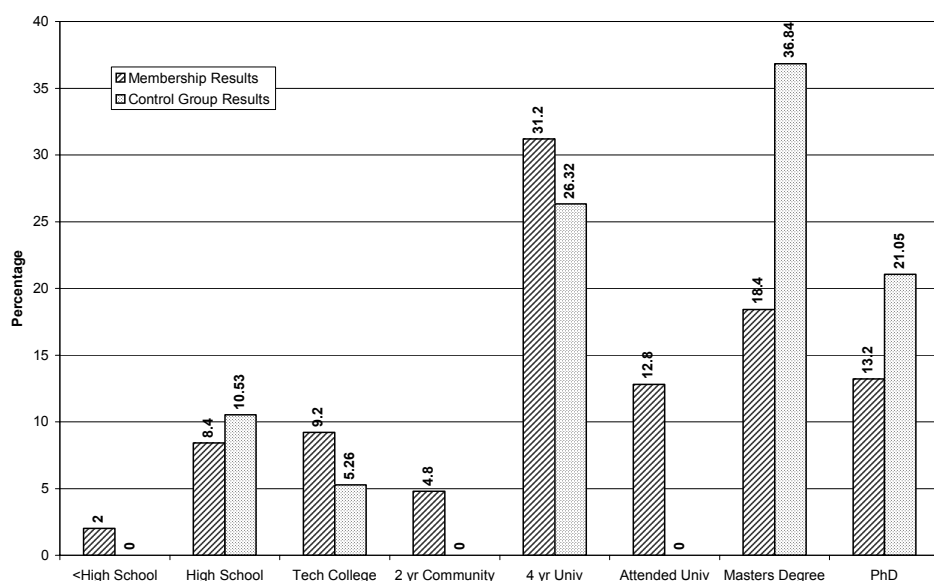


Figure 3  
Educational levels among AMSAT members

issue an electronic version of the *Journal* at some future time, we should NOT replace the present traditional printed version. As a matter of fact, we should build on the great following the *Journal* has. It is an **Institution** in our organization. ARRL has taken a bit of criticism over the years for being a “publishing house”. Aside from the necessity for someone to take that role, it is obviously a strong member link, and they figured that out years ago! It is astounding how many members that do not actually operate on the AMSAT birds treasure the wealth of educational information provided by the *Journal*. There is little question that we would jeopardize their membership if we stopped producing the *Journal* in hard copy.

### AMSAT e-mail Alias Service

Only **31%** of our membership report using this service (Figure 11). That translates to about 1200 AMSAT member users. In fact, some 12,824 persons are registered for this service. Ninety percent of the registered users are not AMSAT members and create traffic and latency for our members as we handle non-member’s traffic. Your Board of Directors will further evaluate the structure of this service.

### AMSAT Web Site

The AMSAT Web site also has a strong following (Figure 12) with **83%** of the *General Membership* reporting use of the site.

A follow-up question asked respondents to evaluate their “ease of use” (Figure 13). Generally, the Web site was given good marks. With the extensive work done in

2004 on developing a new AMSAT-NA web site, we can expect even greater use of the site, and hopefully, increased membership derived from the features available to members.

### Opinion Set

A substantial number of questions dealt with member’s attitudes on choices we have to make over the next few years.

### Educational Outreach

Respondents were asked how important it was for us to have a *University Outreach Program* (Figure 14). The overall concentration was toward Very Important (1)

with **91%** voting neutral (5) or above. This is a strong vote in favor of such activities. It is very important to the future of AMSAT that we enhance our involvement in this area. From mentoring universities, to flying university experiments this relationship can lead to funding sources vital to both of our futures. Additionally, the university relationship will foster future “Bird-Builders”, necessary for AMSAT’s future and the commercial satellite industry within America.

The same question was posed for education level K – 12 (Figure 15) and it too did very well with an **84%** favorable, neutral (5) or above. Implementation of K-12 programs will require much more curriculum creativity since such programs are basic in nature and most students at that level lack the necessary math and science background.

In both cases the *Control Group* agreed with even stronger feelings.

### Human space flight

In this case respondents were required to vote for or against the project (Figure 16). A **resounding 72%** of the *General Membership* said “Yes” to AMSAT’s involvement in these programs, a strong case for continuing support and leadership in this cooperative effort with NASA and the ARRL. The Control Group was unanimous in their support. A minimal 7% voiced specific opposition to the issue, while 20% had no opinion.

### Which satellites do you prefer? (Orbit Preference)

We specifically asked if you would prefer: several LEO passes per day, one long HEO pass every other day, or both (Figure 17).

Professional Career ?

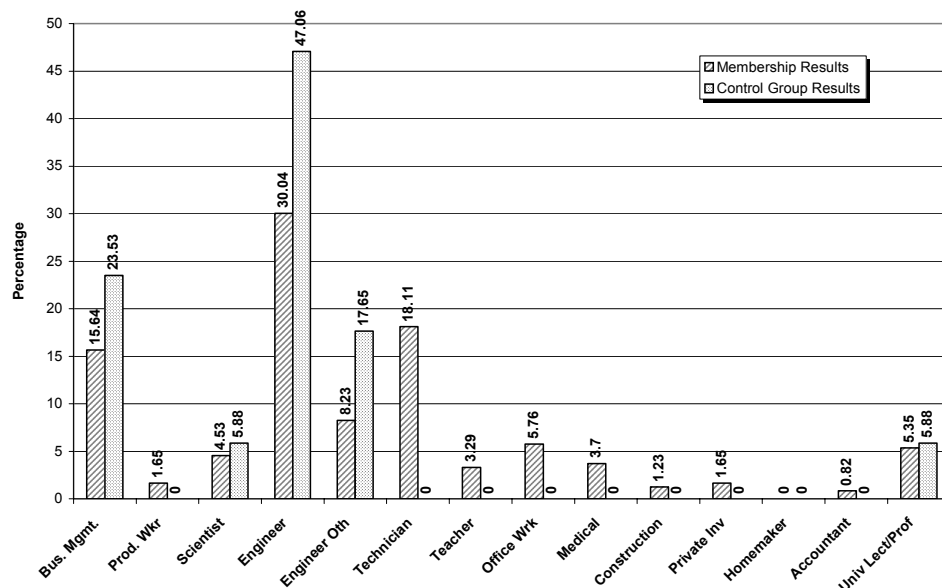
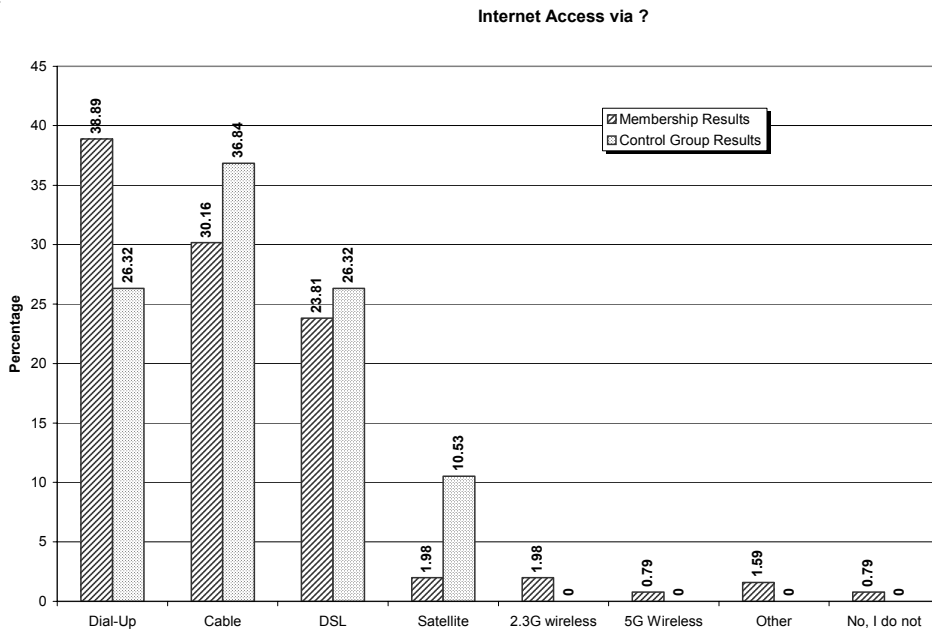


Figure 4  
Member career types







**Figure 5**  
How our members connect to the Internet

There is little question that there is a definite market for both. It is apparent that users prefer HEO to LEO more than 2:1. Given the higher degree of skill involved with most HEOs and the additional background information regarding band use, it is apparent that the LEOs continue to have a significant role in AMSAT's future.

### On-air activities

In an attempt to better understand the "on-air" activities of our members we asked which ham activities they regularly engaged. Local FM repeaters took first place with traditional HF activity ranking second (Figure 18). (The M-P in Figure 18 represents Mobile or Portable.)

### Extra contributions

When asked if you would make extra contributions to help build a bird of your liking: 72% said yes. They were then asked to indicate which birds they would financially support? (Figure 19) HEO SSB leads the way with a great deal of interest in GEO and third place LEO FM. While Geosynchronous did very well, the issue of "station-keeping" with its large in orbit fuel demands make a GEO bird a very expensive proposition.

### If we could only do one, which should it be?

One LEO – 1-2 years, One Phase 3 HEO every 5 years, one Phase 4 every 8 years, one Phase 5 every 10 years, or full time focus on human flight. The majority (53%) of the members said "fly the HEO every 5 years", followed by 31% preferring an LEO every 1-2 years (Figure 20).

### Strength of feeling

To best understand how strongly both the *Members Group* and the *Control Group* felt about given modes within specific orbits, we asked a series of questions that required the respondent to illustrate their interest on a scale of "1" to "10". "1" equaled "Very Interested", "10" equaled "Not Interested". Since we were interested in their weight of interest, we tallied all responses from 1 to 5 (a neutral position). The absolute winner in overall desirability among members and the *Control Group* was SSB, riding on a Phase

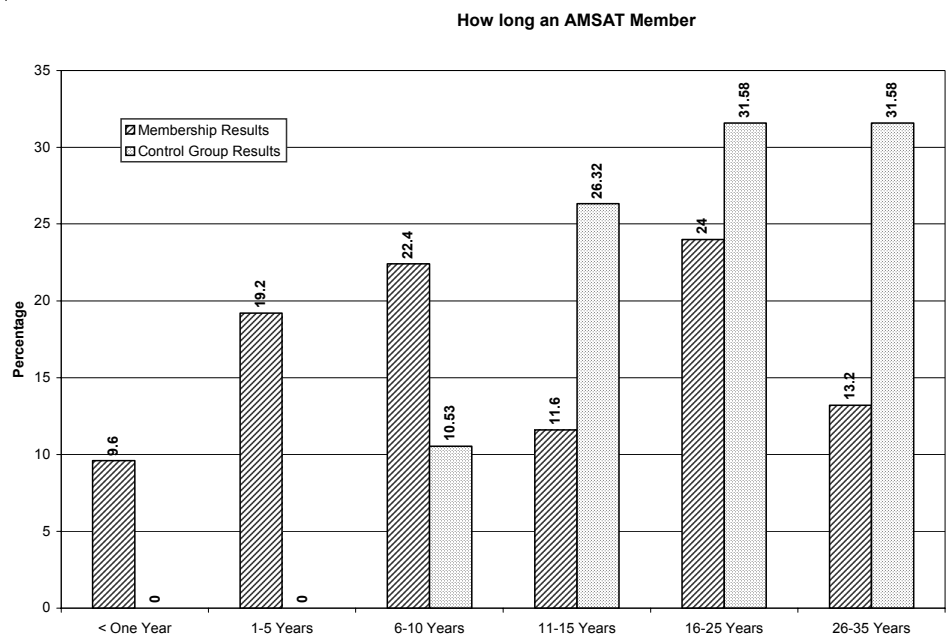
III HEO bird (Figure 21). Second place by the *Membership Group* was SSB on a geostationary bird, while second place from the *Control Group* was digital on a Phase III bird.

Very little interest was shown by either group in the Phase V options with the exception of the *Control Group* that displayed a score of 66.68 in the digital modes of a Phase V spacecraft. It is fair to say that the interest in digital Phase V is centered on the limits in ground technology that restrict the use of Phase V spacecraft to that mode. The distances involved preclude the easy use of FM or SSB.

### New Satellite Activities

We were interested in our member's interest in activities other than conventional voice exchange (Figure 22). Some of the proposals are relatively new while others have flown before. The *Control Group* leaned toward the transmission of data while the *General Membership* leaned toward crossover ancillary interests. Space photography was flown on AO-40, but due to the potential problems of momentum wheel stabilization after the incident, little activity took place. It was interesting that the YACE black and white camera aboard AO-40 became a vital tool in the determination of the spacecraft latitude and longitude. Those interested in how this process was implemented can see the full documentation by visiting the [amsat.org](http://amsat.org) web site and downloading the YACER package, which discusses the process and describes the software involved.

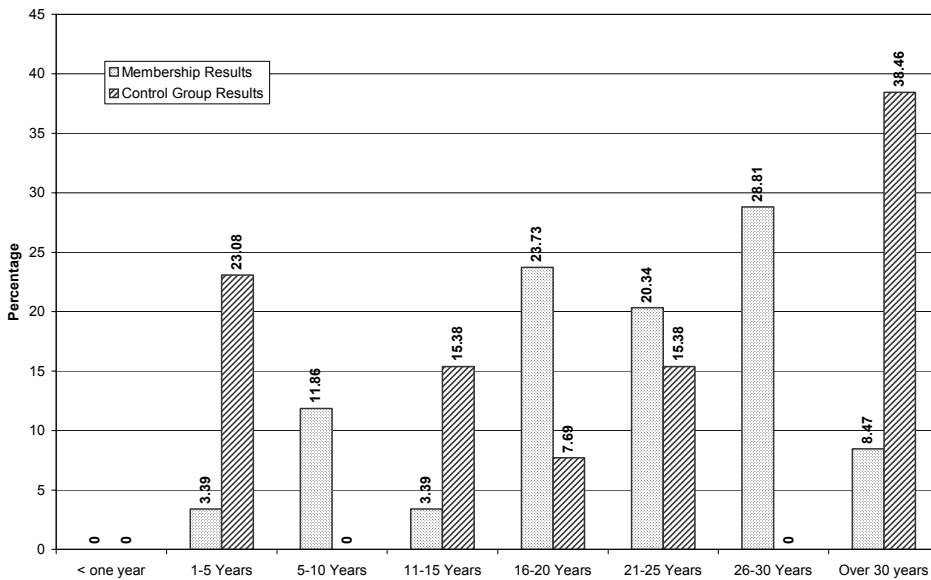
Through the mentoring efforts of Jim White,



**Figure 6**  
Length of AMSAT membership



#### Life Member How Long?



**Figure 7**  
Length of Life Membership

WD0E, a space telescope will fly on an upcoming AMSAT flight. When fully implemented this payload will provide full star-sighting navigation.

The interest shown by the *Control Group* in wideband and multi-mode will come to fruition in the Eagle I and II flights with the implementation of the C-C Rider package which will permit a completely new approach to digital voice and data transmission on an amateur platform.

#### University experiments using the ham bands

Respondents were asked if university experiments would be acceptable on AMSAT birds, specifically for telemetry and control. **51%** said yes, **21%** no and **28%** had no opinion. This is an area we must explore to enhance our relationship with the educational community.

#### Purchase commercially built hardware?

When asked if we should buy commercial hardware, if necessary, for the building of new birds: **71%** said yes, **5%** no, and **24%** no opinion. AMSAT-NA has already ventured into this arena with AO-51 (Echo) and had positive results.

#### AO-40 Review

In response to our question regarding the “effectiveness” and “pleasure-level” of AO-40:

**26%** said they “just loved it”, **10%** said it was “OK, just another bird”, **4%** “tried it and did not like it” and **60%** are “not equipped to use it”. The last response must be balanced with the fact that popular

conventional modes did not perform on AO-40. The response does illustrate that of those who were equipped to use it the vast majority found it a very enjoyable bird to use. Many comments were received referring to the tremendous learning experience AO-40 was such as tuning microwave skills never before used.

#### Satellite Mode Preferences

We asked the respondents to rank the Modes, #1 being the most favorite (Figure 23). SSB took first place, followed by FM and then digital. “Other” includes CW.

We then asked respondents to rank Transponder Configurations (Figure 24). The membership ranked Mode B (U/V) number one, Mode J (V/U) second, U/S third, Mode A (V/A) fourth, and L/S fifth. The Control Group also ranked Mode B first with U/S and L/S tying for second.

#### Regional Meetings

We were interested if members would like more face-to-face meeting opportunity: **53%** said yes, **10%** no and **36%** did not care. Regional meetings, while giving greater opportunity for members to mix, do cost a good deal. That balance must be considered by the Board of Directors. There are possibilities for joining with other organizations to plan combined meeting opportunities.

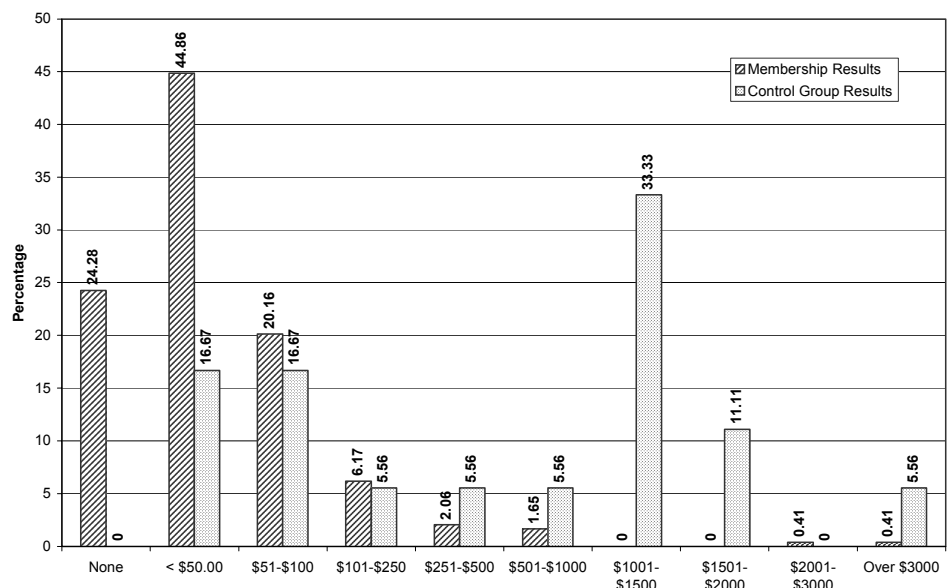
#### Bequest to AMSAT

**34%** of the respondents said they were willing to think about including AMSAT in their estate planning. This is a great opportunity to have one’s “love of AMSAT and space”, live on for future generations to share. Anyone interested in obtaining details can contact me at [w8gsm@amsat.org](mailto:w8gsm@amsat.org). We will be glad to provide sample documents and assist in any way that you would find helpful.

#### Ham bands you regularly use?

Given the aging of our membership as well as the Amateur Radio universe and the population as a whole, we thought it would be interesting to see the interest in a number of historical bands even though they do not necessarily directly relate to satellite operating (Figure 25). Two meters, 70cm

#### Annual Contribution to AMSAT ?



**Figure 8**  
AMSAT Contributions



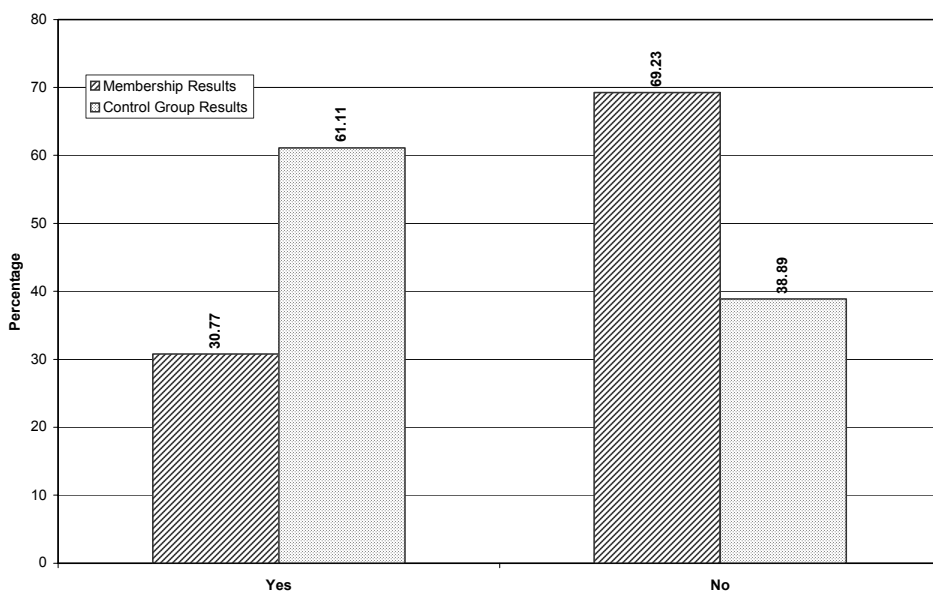


Figure 9  
AMSAT-bb use

and 20 meters continue to top the list. It must be pointed out that respondents were asked to list all the bands they regularly used, so these are duplicated responses.

### Comments Received

The comments received, covered the waterfront, and gave a real insight into the views of our members. I have assembled a

number of select comments that generally reflect the broad spectrum of the hundreds of comments received.

- "I am returning the \$2.00 as a donation to EAGLE"
- "I started off with RS 12/13, progressed to UO-14, AO-7, AO27, FO 20/29. But I enjoyed AO-40 the most."
- "FM LEOs are an easy way to bring in new members."
- "Keep up the good work! My agenda is to use satellite communications to show young people how exciting and fun science and technology could be."
- "I am not currently active on the ham bands, but I have been licensed since 1953 and hope to get back on the air and experiment with the satellite frequencies."
- "Have not used sats since Oscar 7 but feel the program most valuable so please accept my 2004 \$ support. - \$100.00"
- "On technical matters, the board's judgment should be given more weight than this survey."
- "Good Luck"
- "This survey is a great initiative and hopefully will provide the BOD with good,

## Satellite Contact Report Analysis Prediction

AMSAT is now the North American distributor of SCRAP, a satellite tracking program designed specifically for ham satellite applications

| SCRAP 1.26 Satellite Contact Report Analysis & Prediction |            |            |         |           |            |                    |          |             |         |       |
|-----------------------------------------------------------|------------|------------|---------|-----------|------------|--------------------|----------|-------------|---------|-------|
| Coordinated Universal Time<br>Tue 06/04 01:25:31          |            |            |         |           |            |                    |          |             |         |       |
| Initialize                                                | Earth View | Target QTH | SimTime | Ephemeris | TLE Viewer | Pass Reports       | APRS     | Multi Track | Antenna | Auto  |
| Current Pass                                              | Az         | El         | Lon     | Lat       | Range      | Alt                | Depth    | Sqrd        | Dist    | Dist  |
| AO-10                                                     | 244.6      | 2.7        | 176.7   | -5.0      | 28401      | 23006              | 143.8    | 0.0         | 67      | 12663 |
| AO-36                                                     | 125.7      | 18.5       | 252.3   | 38.3      | 1835       | 752                | -11.9    | 0.0         | 6       | 5305  |
| AO-90                                                     | 3.1        | 14.1       | 239.5   | 61.9      | 1822       | 688                | -10.1    | 0.0         | 63      | 5608  |
| Predicted Pass                                            | Az         | El         | Lon     | Lat       | Range      | Alt                | Depth    | Sqrd        | Dist    | Dist  |
| AO-23                                                     | 314.3      | -3.5       | 174.4   | 60.7      | 4756       | Tue 06/04 01:25:15 | 00:01:48 |             |         |       |
| AO-18                                                     | 136.8      | -46.8      | 292.7   | -37.4     | 10306      | Tue 06/04 01:40:05 | 00:22:33 |             |         |       |
| AO-27                                                     | 163.6      | -67.6      | 270.3   | -47.8     | 11675      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-7                                                      | 144.6      | 56.9       | 300.2   | 58.1      | 12231      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-19                                                     | 178.7      | 72.6       | 53.6    | -80.4     | 12574      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-15                                                     | 282.8      | -20.1      | 98.6    | -31.4     | 14100      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-25                                                     | 234.9      | 85.5       | 81.0    | 13.6      | 11479      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-40                                                     | 79.4       | 42.3       | 3.6     | -18.8     | 13066      | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-17                                                     | 310.8      | 42.8       | 114.1   | 24.5      | 3779       | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |
| AO-31                                                     | 284.8      | 41.9       | 136.4   | 9.4       | 9673       | Tue 06/04 01:50:25 | 00:25:25 |             |         |       |

### Functional Features

1. Initialization
2. Earth View
3. Target QTH
4. Date/Time Simulation
5. Ephemeris
6. TLE Viewer
7. Pass Reports
8. APRS display
9. Multi-Track display
10. Antenna rotor control
11. Astronomical prediction

### Recommended minimum processor

1. Windows 98 or better
2. Pentium Processor 500 MHz or greater
3. 256 MB RAM
4. Graphics accelerator card desired
5. 1024 x 768 resolution recommended

**SCRAP** is a product of the  
Bytheway Software Development Lab (BSDL)  
More info at <http://www.rtty.com/bytheway>

### Performance Features

1. Contact Prediction / Reports
2. SGP/SDP ephemeris prediction
3. Real-time 3-D visualization
  - a. City, country, satellite labels
  - b. Lakes, rivers, islands
  - c. National boundaries
4. Over 25 Earth texture overlays
5. APRS station display
6. Multiple ground station support
7. Antenna rotor Az/El control
8. Internet updates
  - a. Two line orbital elements
  - b. APRS station locations
9. Astronomical data (Planets, moon)
10. Simulation

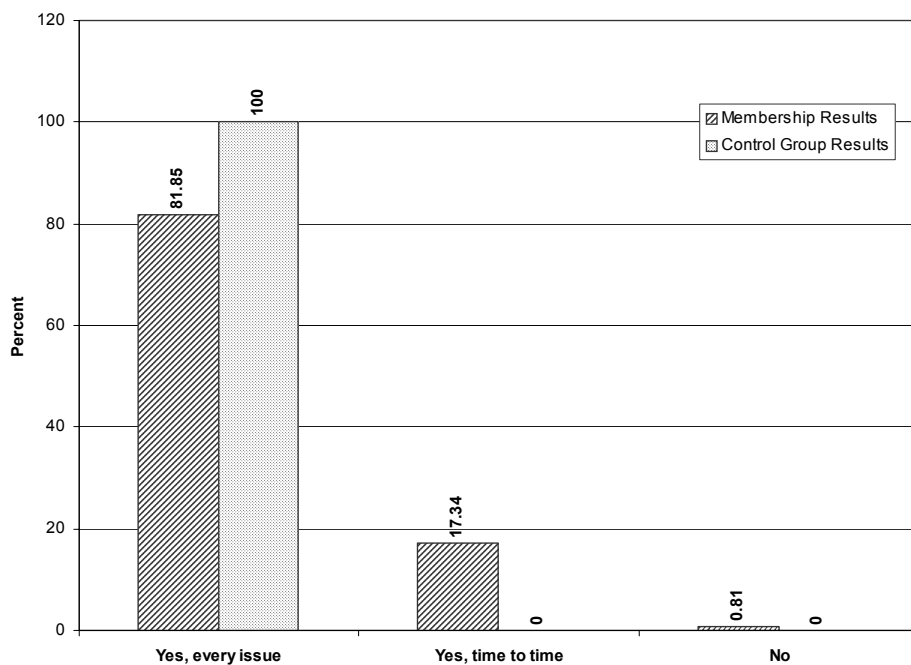
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### Regularly Read the Journal ?



**Figure 10**  
**AMSAT Journal**

positive feedback for strategic planning purposes. AMSAT is a great organization! Very honored to participate in the survey...Thanks."

- "Need another AO-10 or 14 type sat. Made more friends around the world than on HF, especially now. Thanks for your interest in the AMSAT members."
- "Push the envelope, certainly, but don't ignore the majority who need access to sats with off the shelf equipment that is readily available – Keep It Simple."
- "Sats seem to be missing the "Gee-Whiz!" factor. Real technical challenges needed! It's the tech people that make this move, not the FM repeater crowd."
- "Could not give opinion of satellites as I have never used a satellite. Just don't have the equipment."
- "Miss UO-14. Tnx to all who made my multimode and portable AMSAT ops possible over the years."
- "The HEO captured my interest and kept me there."
- "I would like to be involved in actual construction of the bird if possible or some small part of the bird, perhaps through and with the help of our local high school or colleges."
- "At my age (78) I now operate very little but still enjoy reading the different magazines."

- "I would like information on how to use and set up equipment for satellites."
- "I support AMSAT because I believe in it – not because I actually use it."
- "I'm very new and have had no success at satellite communications but like the idea."
- "Would like to be more active but antenna limitations some what restrict me."
- "I'm more interested intellectually than

personally involved in sat ops."

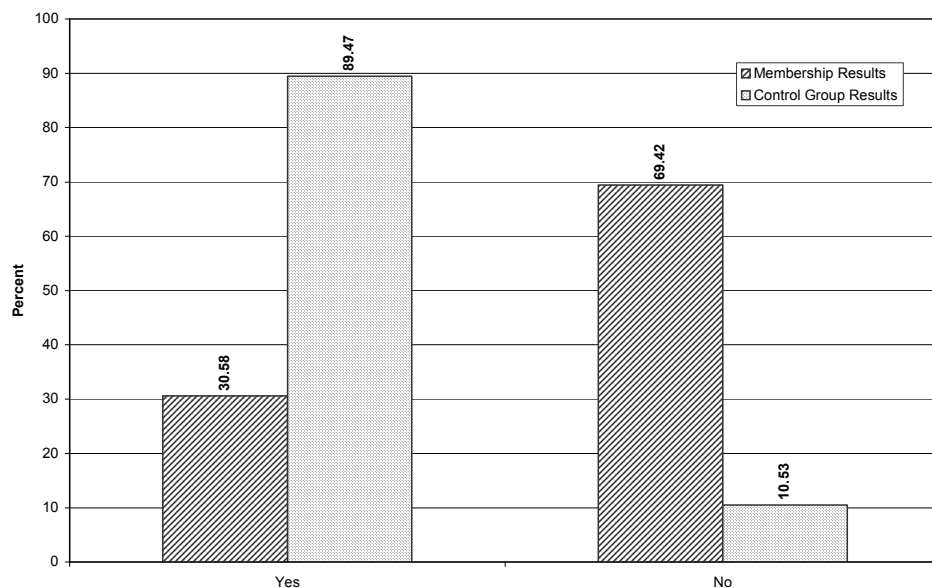
- "Keep ARISS going — it is a high leverage program."
- "I have never been able to get a detailed report on what caused the problem with AO-40. What is AMSAT doing to prevent the problem in the future? This has affected my willingness to contribute again."
- "I am involved with the University Nanosat program and would be interested in extending this program by assisting AMSAT in design/construction of new projects."
- "I have not yet had the time or equipment to use any sat, but guess I would start with LEOs."
- "Thanks to all the volunteers!! I plan to donate more to keep things going."
- "The material published in the Journal should include more items for those new to this form of ham radio."

### Conclusion

This project was very revealing to your Board and illustrates the strong loyalty within AMSAT membership for the ongoing projects on which your Board of Directors are working.

A full copy of the Membership Profile with the raw response percentages for each question, will be available on the AMSAT Web site within the "Members Only" section by early 2005. Cross tabulations can be produced on any specific questions about which the membership or board may wish further information. Submit any such requests to [w8gsm@amsat.org](mailto:w8gsm@amsat.org).

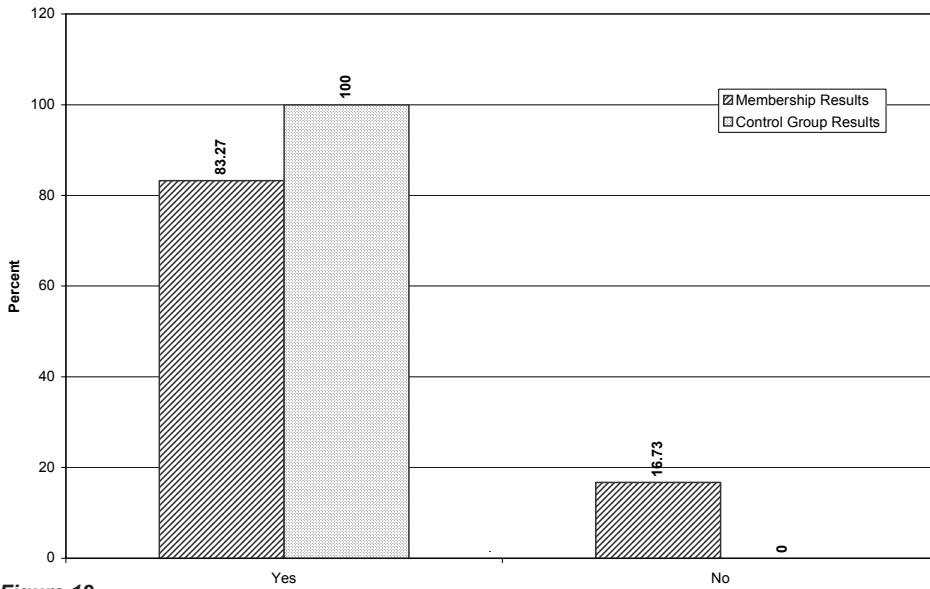
### Use AMSAT e-mail Alias Service ?



**Figure 11**  
**AMSAT e-mail service**



### Access AMSAT Web Site ?

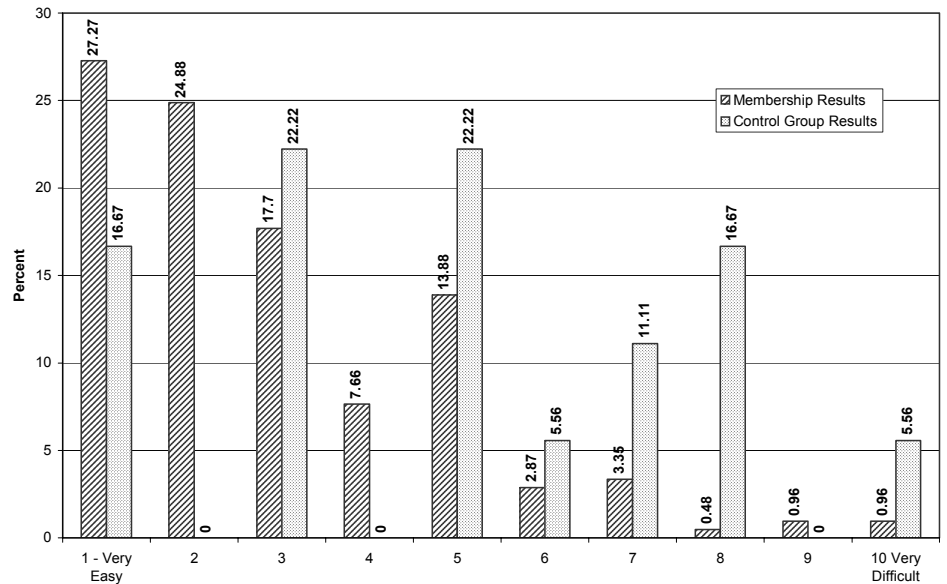


amsat.org - Ease of use

**Figure 12**  
**AMSAT Web site**

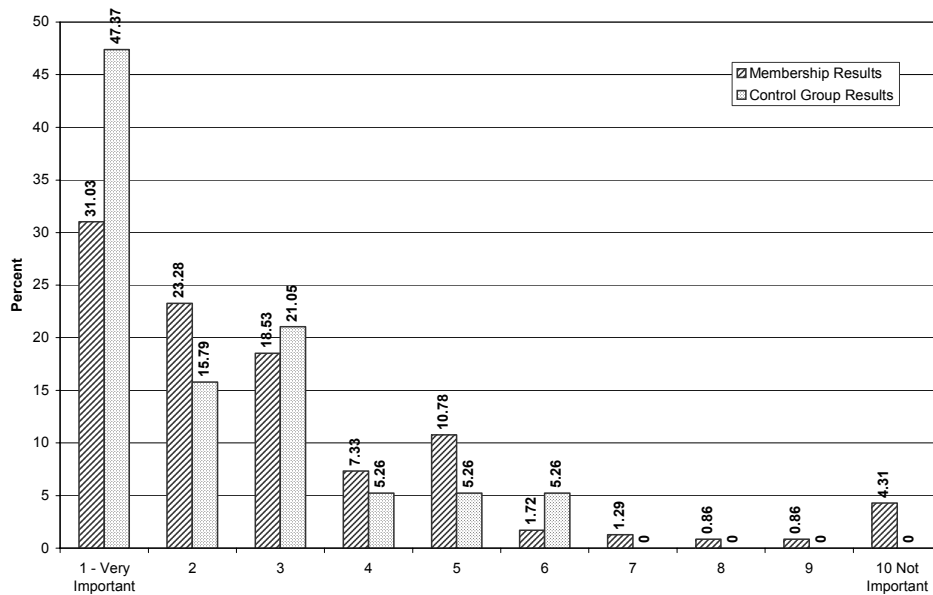
A special "Thank You" to all the members, who took time from their busy schedules to participate. Martha and the office also get a big thank you for the hours they invested, handling all the printing and mailing for this effort.

We hope that after digesting this material you might have some observations and recommendations on how AMSAT can better serve you. Address those comments to any member of your Board of Directors. We will be glad to hear from you. 📧



**Figure 13**  
**Web site ease of use**

### Educational Outreach Program - Universities ?



**Figure 14**  
**Educational outreach preferences**



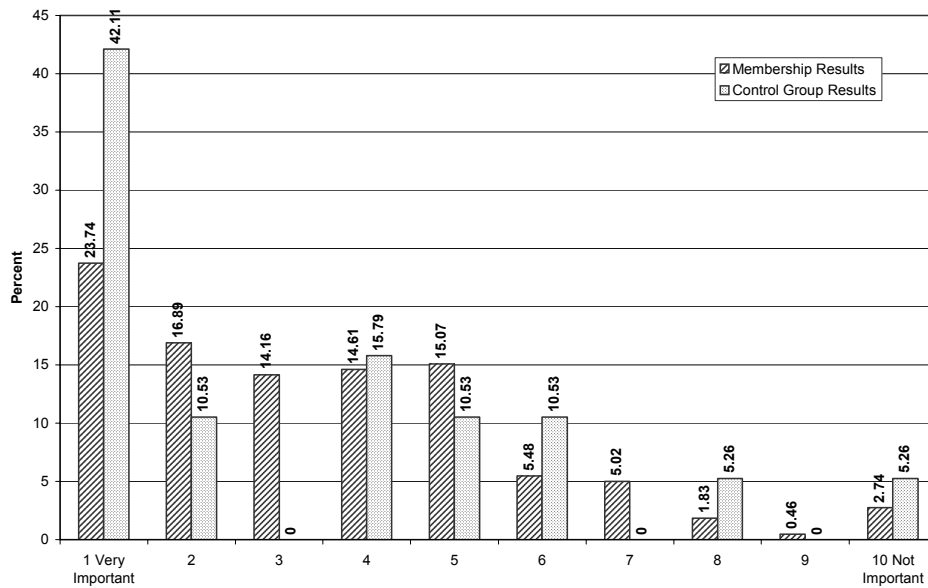


Figure 15  
Educational outreach K - 12

Is participation in Human Space Flight like ARISS & SAREX of value to AMSAT ?

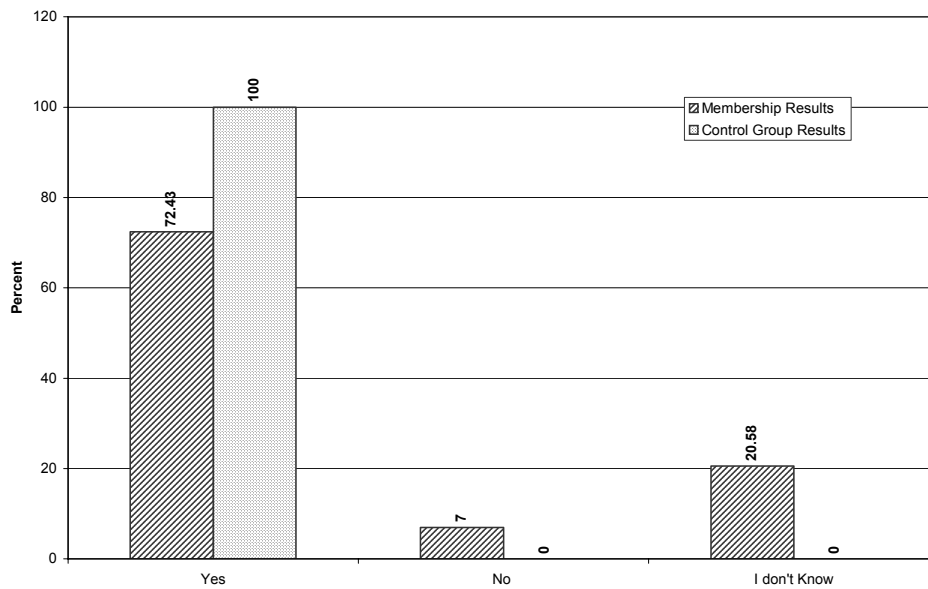
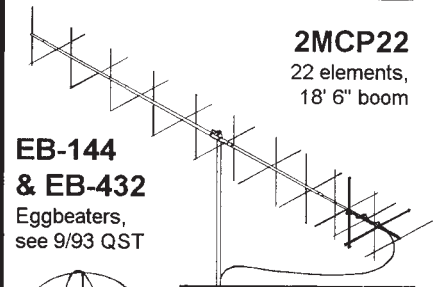
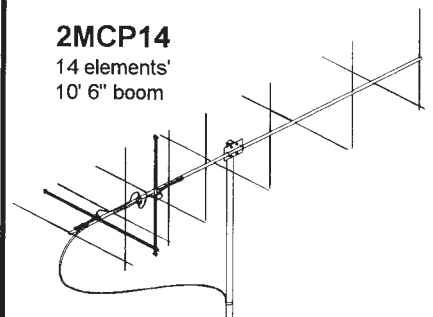
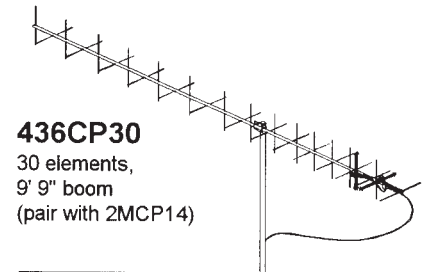
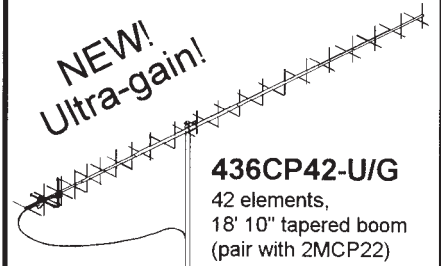


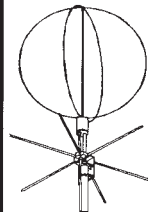
Figure 16  
Value of human space flight participation

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# Orbit Preference

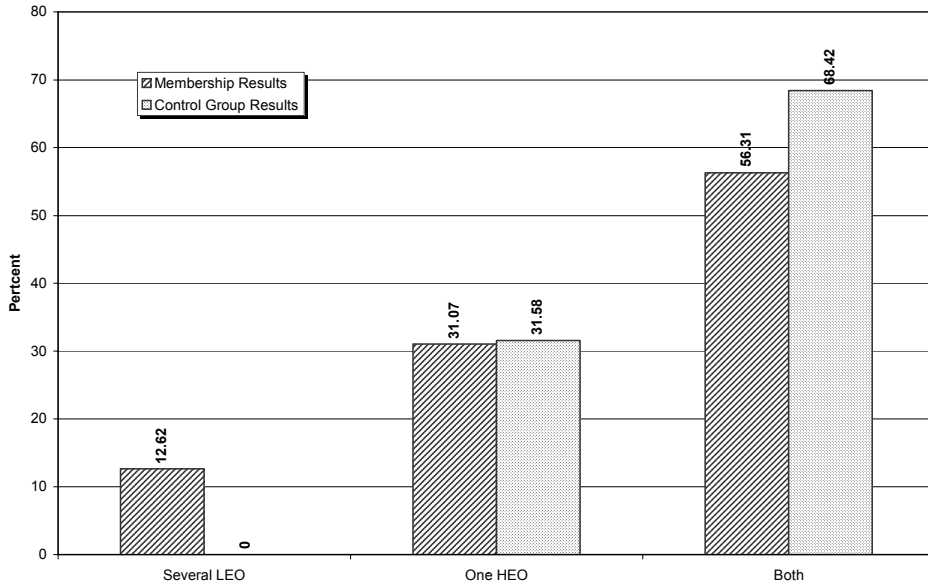


Figure 17  
Orbit preference

# Regularly Operate

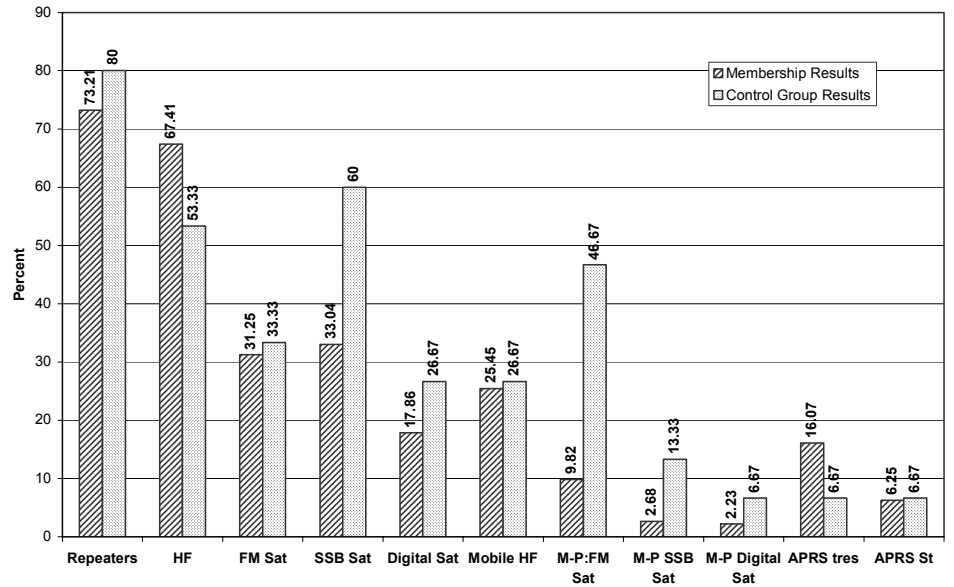


Figure 18  
Types of regular operation

# If Yes, Which would you support ?

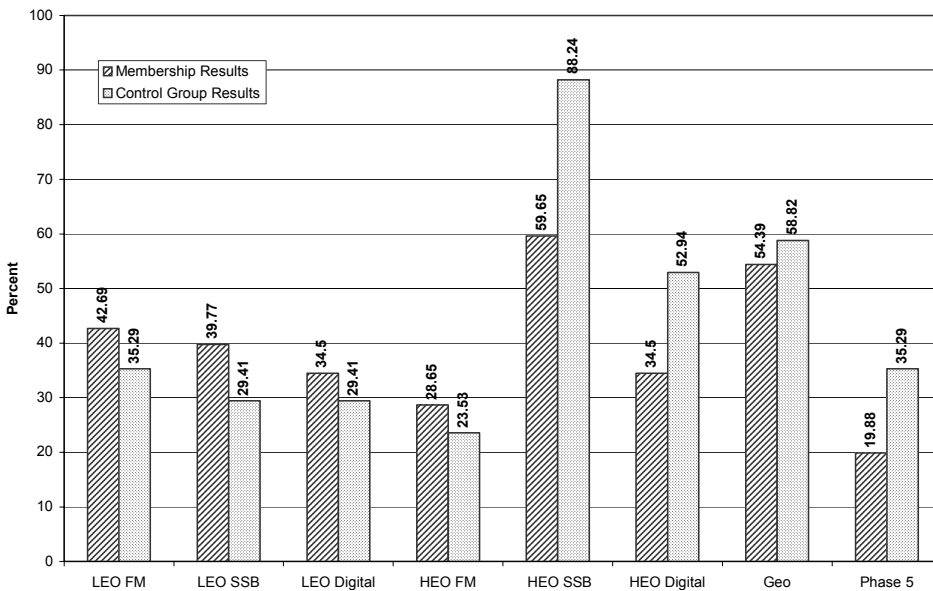
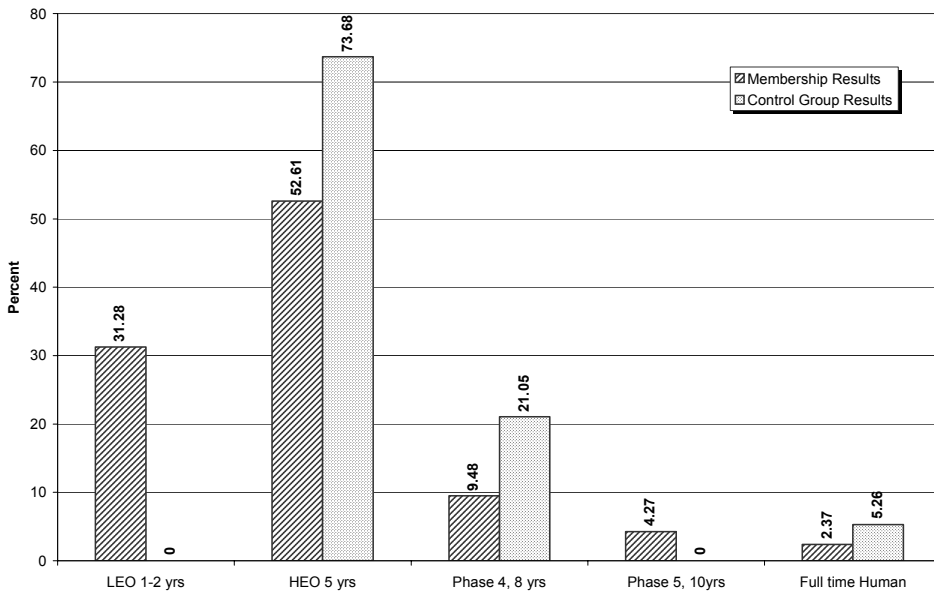


Figure 19  
Financial support for various satellite types

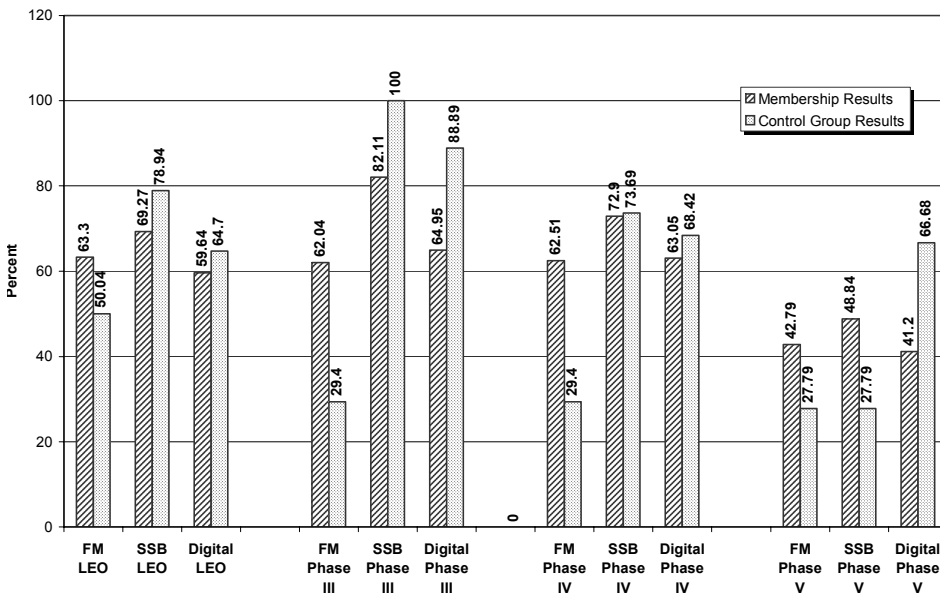


# If Only ONE satellite - Which



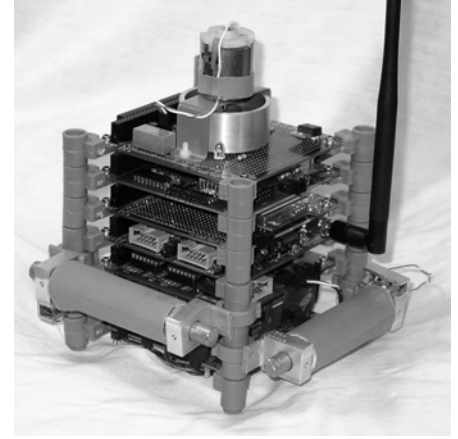
**Figure 20**  
What if we could only have one type of satellite?

# Strength-of-Feelings [Modes /vs/ Orbit]



**Figure 21**  
Strength of Feeling

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# Silent Key

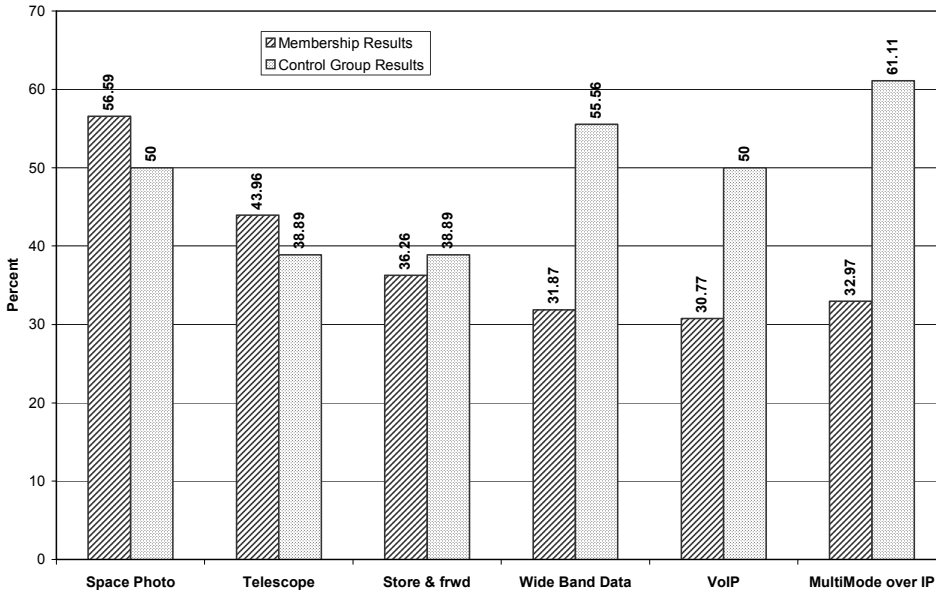
Luciano Bertucci, I1JE, Life Member #1177 died on May 1. Mr. Bertucci worked in Gabon for many years and had the callsign TR8BL. I met him on several occasions when he was visiting Washington. He was an enthusiastic AMSAT member who joined over 26 years ago with the number 3946. He will be missed.

73,  
Martha  
AMSAT Manager



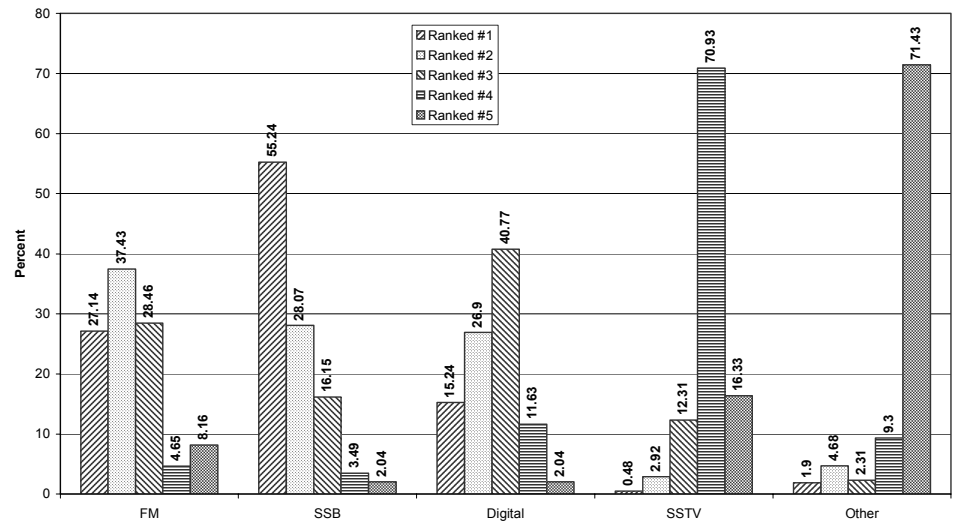
Luciano Bertucci, I1JE/TR8BL (l) and Tom Clark, W3IWI (r) at the Goddard Spaceflight Center in September 1981.

# New Satellite Activities

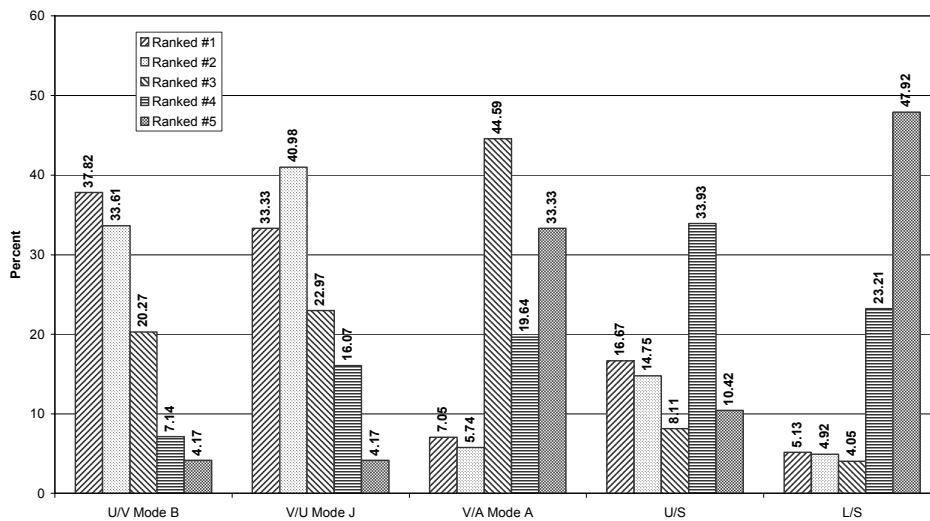


**Figure 22**  
New activities

**Figure 23**  
Membership mode ranking



# Transponder Configurations Ranking (Membership only)



**Figure 24**  
Transponder configuration preferences



Bands Regularly Used

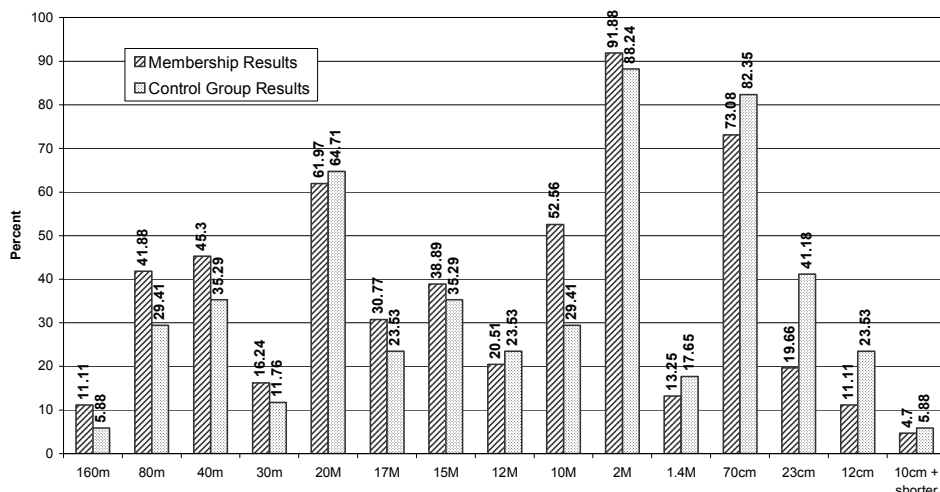


Figure 25  
Bands most used by members

## YOUNG LADY FROM CANADA WORKS THE BIRDS

Here's a story of a young lady in Manitoba, Canada that is working the satellites and is making contacts! She is ten-year-old Aruni Perera, VE4WMK. Aruni recently took her Advanced class license and scored 100% on the exam and then completed her 5 wpm Morse code requirement. Aruni is quite interested in satellite work. Armed with her Arrow antenna and Icom W32A, she has made numerous contacts on SO-50. This morning, July 30, she had her mother (her father was at work) take her over to the school grounds and made her first contact on AO-51.

She is a remarkable young lady and is generating quite a bit of interest in working Satellites here in Winnipeg. Both she and her father have offered to assist me in setting up an AMSAT display table at our swap meet in October.

Aruni's father's name is Kumara, VE4WKP and is shown with her in the pictures. Aruni was nominated and has now become a member of Project OSCAR. She is the first YL member and only the second international member, the first being Bill Greene, VE7WFG.

On August 29, 2004 Aruni and Kumara assisted me in a satellite demonstration. Although the weather was less than favorable with rain and a heavy overcast, we had fourteen individuals turn out for this demonstration. As stated weather conditions were poor but several contacts were made on AO-51.

I have attached a photo of the gathering

while Aruni is making contacts.

Thanks and 73,  
Gerry Baker, VE4GTB  
AMSAT #29196  
Area Coordinator, Winnipeg, Manitoba

Here's what Aruni wrote about her first experience with AO-51:

Hi to the BB...

My name is Aruni Perera, VE4WMK and I am 10 years old. My third attempt to make a contact on AO-51 was during orbit number was 433. On July 30 at 17:39 UTC, I pointed my Arrow antenna toward the AOS azimuth of 10 degrees from my location. The bird was not more than 20 degrees over my horizon. I heard Egon, VE6EGN, calling two stations. I couldn't hear anyone calling him back. After his second call I decided to give him a call. He came back to me with strong, fully quieting signal to my Icom IC W32A handheld. I was so excited. We completed our QSO without any interference. After the QSO he even had few words with me since I couldn't complete my AO-51 QSO with him on the previous night due to QRM.

I am a ten year old full licensed YL looking forward to making many more contacts on AO-51. Congratulations Echo team! You did a great job. Good luck with your next project.

73,  
Aruni Perera, VE4WMK

Aruni maintains a log of her contacts on a Web site with the help of Emily Clarke,

W0EEC. Are you in Aruni's log?

See:

<http://www.emilyshouse.com/W0EEC/aruni/>

for Aruni's recent contacts.

And also:

<http://www.projectoscar.net/feature.php>  
for more info on Aruni and her satellite work. ☺



Aruni, VE4WMK, with her father Kumara, VE4WKP and AMSAT's Manitoba Area Coordinator Gerry Baker, VE4GTB making a contact.



Aruni shows the crowd how it's done!



As a result of the 2004 AMSAT Board of Directors elections, W3IWI, W5DID and N6TX will serve on the Board for two years. The first alternate is KK5DO and the second alternate is W4EPI. The results of the voting are (993 votes were cast):

|                    |     |
|--------------------|-----|
| Tom Clark, W3IWI   | 769 |
| Lou McFadin, W5DID | 628 |
| Paul Shuch, N6TX   | 465 |
| Bruce Paige, KK5DO | 450 |
| Steve Diggs, W4EPI | 313 |
| Lee McLamb, KU4OS  | 268 |

Submitted by  
Martha Saragovitz  
AMSAT Corporate Secretary

## Eighth Annual Southeastern VHF Society Conference

The 8th Annual Southeastern VHF Society Conference was held this past April in Atlanta. The conference was a big success, and we had a great group in attendance. The presenters provided us with a quality program, and there was an overall feeling that it was a special conference, with fellowship and learning in abundance. A full report on the conference activities, along with a photo gallery, has been posted on our Web site at [www.svhfs.org](http://www.svhfs.org).

Now, get out your calendar...

The 9th Annual SVHFS Conference will be held in Charlotte, NC April 29 & 30, 2005! North Carolina is a new state for us to visit with the conference and is in keeping with our goal to move the conference around in the Southeastern region. Guy Titman K4NUS has offered to be host and facilities chair for '05.

As if that isn't enough... dig further into your calendar and mark out a spot for 2006. We will be heading to Greenville, SC April 28 & 29, 2006! Another new state for the conference! Jack Jackson, W4EFZ will be our '06 host.

Our collective thanks to Guy and Jack for stepping up and offering to help out! Way to go guys!!!!

Proceedings from 2004 and 2003 are available via the website with three offers; 2004 - \$24, 2003 - \$15, combo with both 2003 & 2004 - \$35. Prices include shipping. Full details at: [www.svhfs.org/proceedings.htm](http://www.svhfs.org/proceedings.htm)

Good things are happening here in the SVHFS so come on down and be a part of it. We will be happy to see you!

The Southeastern VHF Society is on the Web at [www.svhfs.org](http://www.svhfs.org).

**AMSAT** is the North American distributor of **SatPC32**, a tracking program designed for ham satellite applications. For Windows 95, 98, NT, ME, 2000, XP.

*Version 12.2 now supports Labjack U12 and W0LMD rotor controllers and Doppler tuning for Yaesu FT-817/857/897.*

### Features:

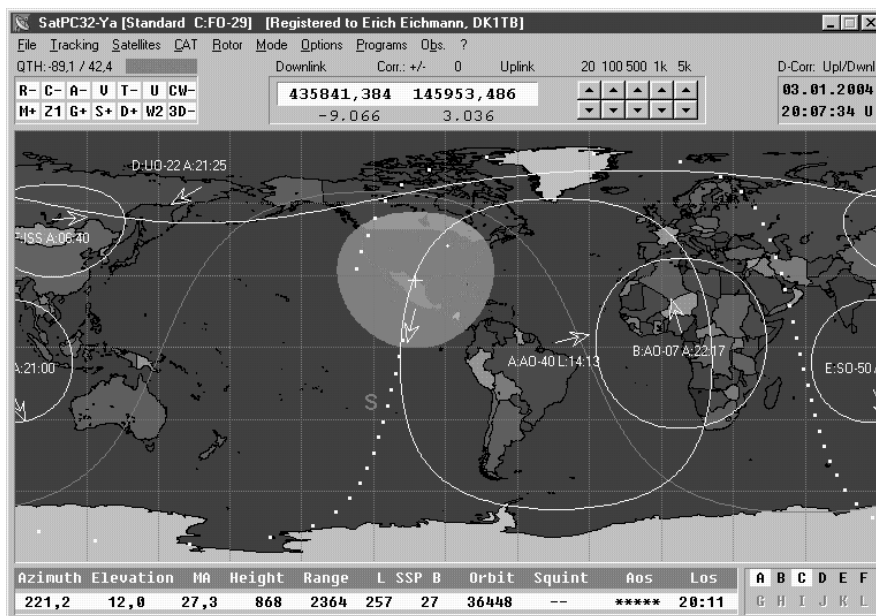
- Graphical tracking on a world map with two selectable Zoom factors.
- One-click satellite switching using 12 "letter" buttons.
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- Doppler tuning with on-screen frequency displays. Radio models supported: Yaesu FT-847, FT-736R, FT-817, FT-857, FT-897, ICOM IC-820H, IC-821H, IC-910H and other ICOM radios, Kenwood TS-790 and TS-2000, DDE client programs
- "Transparent" VFO-knob tuning in addition to keyboard and mouse tuning.
- "Virtual" VFO tracking for half-duplex transceivers FT-817, FT-857, FT-897.
- Includes a special version for ISS split-frequency operation.
- Controls subaudible tone on FT-847, FT-736R, FT-817/857/897, and IC-910H.
- Includes a non-graphical version and programs that output lists to the screen, printer, or a file.
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Price is \$45 for AMSAT members, \$50 for non-members, postpaid on CD-ROM.

A demo version may be downloaded from <http://www.dk1tb.de/indexeng.htm>. A registration password for the demo version is \$40 (members), \$45 (non-members).

Order by calling 1-888-322-6728, or use the online shop at [www.amsat.org](http://www.amsat.org).

The author DK1TB donated SatPC32 to AMSAT. All proceeds support AMSAT.



73,  
Greg Robinson, KB4NVD  
SVHFS Publicity Chairman  
[Rover@wireco.net](mailto:Rover@wireco.net)  
[www.svhfs.org](http://www.svhfs.org)

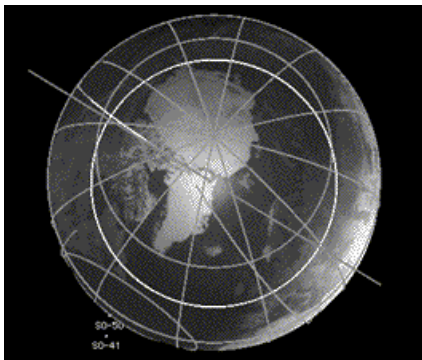
SVHFS Conference, Charlotte, NC  
April 29 & 30, 2005

SVHFS Conference, Greenville, SC  
April 28 & 29, 2006



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MacDopplerPRO X provides separate windows for the map (2D or 3D), the radio controls, and the sorted table of upcoming satellite passes. A Horizon window graphs upcoming passes as a function of elevation over time for status at a glance.

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- Ultra Low Noise LNA's 50.0 MHz. 24.0 GHz.
- Transverters 50 MHz. - 24.0 GHz.
- Antennas - Rotors
- Downconverters and TX Upconverters for all P3D frequencies
- Mode "S" Downconverters
- Mode "L" TX Upconverters
- Linear Amplifiers 50 MHz. - 24.0 GHz.
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- Transverter Kits 1.2, 2.4, 5.7 & 10 GHz.
- Parabolic Dishes

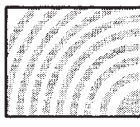
### So What's New ?

**BEKO Electronic:** 144 MHz. - 1296 MHz. Linear Amplifiers 100 Watts - 1200 Watts

**DB6NT Electronic:** MKU 24 OSCAR Mode "S" Downconverter IF 144 or 432 MHz.  
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## P3E Update

by Frank Sperber, DL6DBN

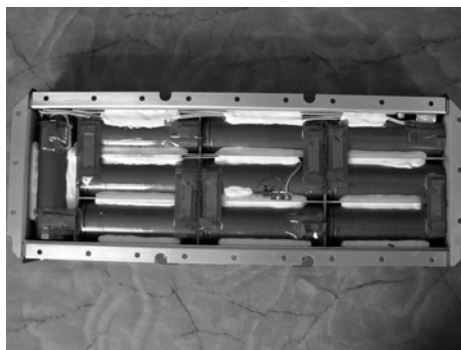
Originally published in the AMSAT-DL-Journal of Sep/Nov 2004

Translated from German by John Bubbers, W1GYD

Things are happening with P3E. This is a progress report on how the satellite is coming along since the last report published in *The AMSAT Journal*. P3E is coming closer to the moment when the integration of the electronics can begin.

### Electronic Modules in Progress

The main battery is available as one of the first modules. Two sets of 10 units were selected from a total of 100 conditioned and measurement-tested storage cells. Horst Wagner has assembled two battery modules from them, one for the working unit during integration and testing and an additional one to be used as a flight module. Meanwhile, planning for an eventual support battery has begun and suitable storage cells will be ordered accordingly.



**Figure 1**  
A view into the still open housing of the main battery



**Figure 2**  
Horst Wagner assembling the battery module. The test module is in progress and the 13 AH, NiMH cells of the main battery are in the foreground.

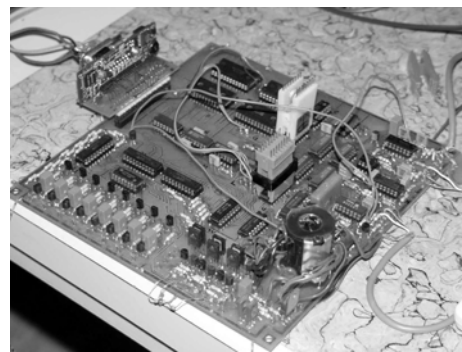
Another electronic module completing development is the Sensor Electronic Unit (SEU) at the AMSAT-DL Marburg location. Due to the introduction of the CAN-Bus on the satellite, there were major modifications necessary related to the interface design of the earlier SEU version.

Before a flight unit can be built, the SEU will undergo extensive tests.

Progress has also been made on the transponders for the main bands. A team from AMSAT-New Zealand has offered to help with the transponder construction. Currently that team is examining the availability of suitable building blocks to connect to the previous transponder design.

### Helium Tank – Pressure Test Successfully Completed

As with all earlier P-3-satellites, AMSAT P3E will have its own propulsion system to propel itself in the desired orbit from the geo-stationary transfer orbit (GTO) of the Ariane-5 rocket. The height of the perigee, and especially the inclination, must be increased.



**Figure 3**  
The SEU on the laboratory table for measurement purposes



**Figure 4**  
The helium flask burst at 1600 bar. It has to withstand 400 bar on board P3E.

P3E requires a helium tank for the propulsion system of at least 400 bar, with a volume of about 2 liters. The container is wrapped with a carbon filament fabric and must be able to withstand the high pressure.

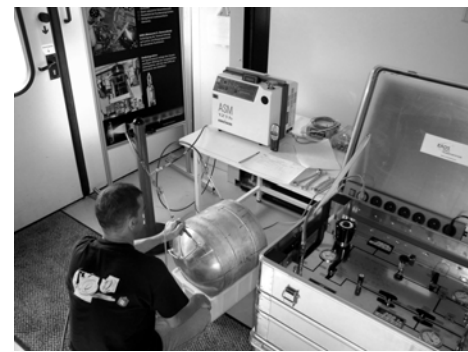
Additional certification tests were required with high safety factors to satisfy the high safety requirements of the rocket. For this the propulsion team (Martin Riehle, Thomas Maier and Wolfgang Müller) along with the

EADS space transportation ([www.eads.com](http://www.eads.com)) in Lampoldshausen performed several tests with the complete P3E high-pressure apparatus.

Initially, there was a three-week life and leak test at 50 bar. Then there were two complete cycles as proof test including gas at a pressure of 600 bar, followed by a new life and leak test at 400 bar for one week.

The helium tank was put under a burst test of several cycles at 1000 bar. There were no material fatigue problems or other negative symptoms. Following that there was a destructive burst test undertaken at 1600 bar, which demonstrated the appropriate safety factor.

Everything worked extremely well. The strength and the reserves/safety-factors have



**Figure 5**  
The fuel tank being tested for integrity by the propulsion team at EADS. In the picture Thomas Meier is preparing for the measurements.



**Figure 6**  
The last integrity test of the tank's end.

been proven. The large fuel tank was tested several months ago for integrity and pressure and likewise satisfied the requirements.

### STAR Camera Made the First Astronomic Images

In May there was the opportunity to test the STAR camera for P3E (named for its





## News Release

Gunther Meisse, W8GSM, AMSAT Treasurer

7/25/04

## AMSAT Members "pitch-in" on work that would cost AMSAT thousands of dollars each year to duplicate.

**A** just completed review of work by AMSAT-NA volunteers indicated that during the year 2003, members have contributed over \$236,000.00 of "In-Kind" service in the fields of Education Outreach and Spacecraft Development & Deployment.

Starting with the 2003 financial statement, we will show all these contributions by members to AMSAT. This practice will better show the world the scope of the programs that AMSAT-NA is involved in. Included in the 2003 numbers are work on ARISS, *The AMSAT Journal*, ANS weekly information services, various AMSAT publications, Payload & Spaceframe Development for ECHO and EAGLE I & II as well as Software development for these spacecraft.

We are now in the process of starting to gather volunteer hours for 2004. If you are interested, please review the material below and, if you qualify, send an e-mail to the AMSAT Treasurer, Gunther Meisse, at [inkind@amsat.org](mailto:inkind@amsat.org) to sign up for this valuable AMSAT program.

The time you donate will serve to enhance the appearance of our financial statements, *comply with Generally Accepted Accounting Principals (GAAP)*, all with the hope of "putting on a better public face".

In-kind donations are not necessarily tax deductible by the volunteer. Please consult a tax consultant if you have any questions.

Your submissions will be kept confidential. Only the total dollar values will be released.

The aggregate value, within each category, will be moved to our financial statements, listed under the appropriate category as "In-Kind Services."

#### AMSAT In-Kind Volunteer Time Donation System

In keeping with the AMSAT mission statement we are, at this time, only seeking documentation of In-Kind hours for only the following categories:

- Satellite Development/Operations
- Satellite Design
- Satellite Construction
- Satellite Ground Control Operations
- Software development
- Educational Outreach
- ARISS Design & Construction
- ARISS Ground operations (School Contacts)
- Journal Editing
- Journal Writing
- ANS Editing
- ANS Writing
- AMSAT Publications (Example: "ECHO Operation, Development & Specifications")
- University Lecturing or Mentoring
- University Satellite Meetings (Micro & Cube etc.)

If you spent volunteer hours in any of the above categories and you have a good sense of the total hours you are spending in 2004, we would like to know about it.

We need an hourly rate to assign to the hours you log. The procedure for your selection of that rate is as follows:

We ask you to determine your attributable hourly rate based on your judgment of what the value is, based on the specific work you did for AMSAT. AMSAT will create an internal value list which we will compare against your number to be sure we are not grossly over- or understating these values.

When you select an hourly rate, please be conservative, but absolutely realistic.

As an example: An engineering PhD may figure he was doing entry-level work on one project. We wouldn't want to use \$250 an hour for a project that an engineer, fresh out of college, may be able to complete at a rate of \$30.00 per hour. Please be as realistic as possible.

If you feel you qualify and would like to participate, your e-mail responses to [inkind@amsat.org](mailto:inkind@amsat.org) should include:

- Your Name
- Your Call sign
- Your e-mail address
- The name of the qualified project you participated in, and when
- The hourly rate you feel is reasonable
- Total 2004 hours you spent in this AMSAT endeavor.

We will accept Year-to-Date numbers. Future filings should be from that date forth. (We do not want to have duplication.)

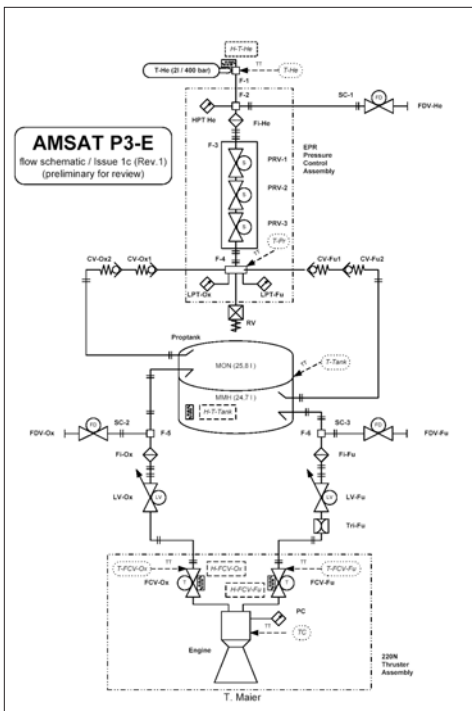
Multiple projects, which should be calculated at different hourly rates, should be separately listed.

As the year progresses we will e-mail you a reminder to post your new 2004 hours, so that at the end of the year we will be ready to move on to a new year.

In-Kind Services to AMSAT - Just another way you can make a difference in the future of satellite Amateur Radio around the world.

We hope to hear from you. If you have any questions regarding the program you are encouraged to send them to the same e-mail address, [in-kind@amsat.org](mailto:in-kind@amsat.org).

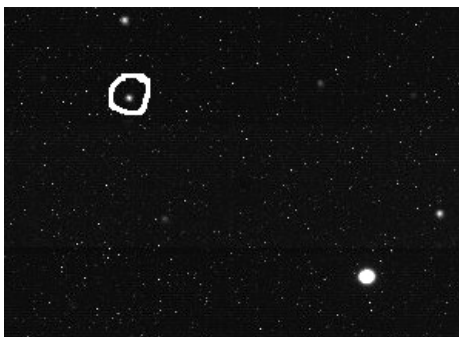
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**Figure 7:**  
**An overview of the drive system of P3E**

development location in Arizona, also called AZStar) with a 150-cm telescope at the Mt. Hopkins Observatory. The camera was mounted on the end of the telescope for this test. At this time the primary instrument was a spectrometer, so only about 2% of the light was available for STAR. Next to a test image of the comet C/2001 Q4 (NEAT) with an exposure time of 5 seconds an image of the planet Pluto resulted with a 25-second exposure. Pluto had a magnitude of 14 at that time. There were no special tricks used in reworking the picture.

Chuck Green writes that with such long exposure times that undesirable effects can be observed. He also wrote that the three nights were lots of fun with the camera and that the test was very instructive for further improvements on the camera.



**Figure 8**  
**The planet Pluto (circled) through the eyes of the P3E navigation camera, STAR. A prototype of the camera was mounted on the 1.5-m telescope of Mt. Hopkins Observatory. Additionally, the camera was set up from time to time after the aiming the telescope.**





## 2.4 GHz – Cleaning Up the Neighborhood

by Bernhard E. Keiser, W4SW, w4sw@arrl.org

For several years I had difficulty receiving the AO-40 downlink. I was hearing a continual popping sound that I could not trace to anything on my premises. In addition, the AO-40 signal strength as received on my array of four 52-element loop Yagis left much to be desired. I replaced my antenna with one of the famed barbeque grill types, but didn't get any significant improvement. About that time I learned of the 3' offset dishes being offered by N3IYR. I had no more space on the boom of my garage roof OSCAR tower, but I had recently erected a quad array of cross polarized Yagis for EME on 2 meters. There was space on the EME array cross boom for the N3IYR dish and it would have a better shot at the clear sky than the garage roof tower, whose antennas have to look through tree leaves in summer.

With the N3IYR dish I use a new Kuhne downconverter. I had thought that the popping sound might be an artifact of my old downconverter, since I could never get a bearing on it from the roof tower, but there the noise was on the brand new downconverter too.

Next I rigged up my old downconverter with a small 9-element loop Yagi for portability, and placed the downconverter in a shoe box along with a 13.8 V battery and an old FT-290 all mode transceiver for the IF. I disconnected the mike and key from the FT-290 to make certain it couldn't transmit accidentally into my downconverter.

At ground level I was actually able to get a bearing on the popping sound. It was coming from down the street, two doors down to be specific. I asked my neighbors there what wireless devices they were using and they denied having any. At this point I became suspicious of the power company and its automated meter reading endeavors. They had always been cooperative when I had power line buzz at VHF during dry weather, and this time they came out to take a look even though they were doing no automated meter reading in my neighborhood. The morning they came, my neighbor's house was in charge of a baby sitter, who was willing to allow them to shut off the power. Bingo. The popping noise dropped several dB, as observable on the S-meter in my shack. They then restored power and began checking one circuit breaker at a time. The offending system was on Breaker #17, and turned out to be a cordless phone system with remotes – yes – operating at 2.4 GHz. Apparently the master queries the remotes

24/7, and each remote replies with its own pulses. This goes on continually whether calls are being made or not. Incidentally, my single line 2.4 GHz cordless phone causes no QRM that I have been able to find.

The homeowner happened to be a communications attorney, so she was well aware of the provisions of Part 15. She just had a hard time coping with the fact that the FCC label on *her* phone wasn't a blanket approval from the FCC. At first her attempts to get a refund from the store and then the manufacturer did not bear fruit, so she asked me to have the FCC send her a letter which she could take to the manufacturer. Believe me, this is not the kind of letter you or I would want to receive. It threatens fines and jail time for those who do not comply. Being an attorney, however, she knew what to do with it. She took it to the manufacturer, who granted her a prompt refund even though the warranty was a matter of history. She now uses a 900 MHz system – another ham band, but her new phone system does not bother my narrow band activities at 903 MHz.

You will note that I mentioned earlier that the popping noise dropped a few dB, but was still present. Yes, there was a second source, this one from a neighbor two doors away in a different direction. His system was a simpler one, just a master and one remote, and made by a different manufacturer, but just as noisy. He wanted to split the cost of a new phone system with me. I told him that would be all right with me, but that it wasn't supposed to work that way. He also had problems with his store and manufacturer, and requested the FCC letter, which he received. He then wished he hadn't asked for it! Now he's using a 5 GHz system.

The noise level was much lower now, but a third neighbor further away had a system somewhat similar to the second, but made by yet a different manufacturer. After I gave him a copy of the FCC letter (with the addressee's name blanked out for privacy), his system went silent.

The fourth source was one that came and went. It had been off while I was quieting the first three. It was closer, but worked on a channel-hopping basis. It might remain on a given channel for the better part of a day, perhaps changing when the phone was used. This neighbor was in the process of moving away, so this problem disappeared on its own.

Things were nicely quiet (except for clean signals from AO-40) until the fall of 2003

when a new source started up. I thought I had located it at a nearby house, but the homeowner there, an attorney with a specialty other than communications, questioned my credibility. During the day his baby sitter had allegedly unplugged the cordless phone system at my request without the noise disappearing. I wanted another test in which I would personally witness the phone being unplugged. He was unwilling to do this and asked on what law I was basing my request. I left him a copy of the FCC letter (addressee's name blanked out). He called the writer of the letter at the FCC and told him he had been fully cooperative, and apparently felt he was off the hook.

At this point I called my friends at the FCC field office at Columbia, MD. Believe me, these fellows are really on our side. They arranged a visit to the home in question. Tests there indicated that the source is elsewhere, so the FCC men came out a second time. They think they may have located the offending system. Time will tell.

Meanwhile, as of the date of writing, Echo is still awaiting launch, so there are no communication signals currently in the 2.4 GHz band. Consequently, at the moment, I can't claim harmful interference. However, Echo should be on soon, and I want to be ready for P3E when it becomes available. For these reasons, my efforts continue. ☎

### What Do You Want To Do While A Satellite's Not In View? GET THE ATV BUG!



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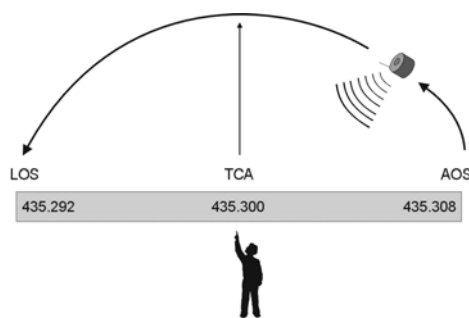


## 12 Suggestions for Success Working AMSAT-OSCAR 51 (Echo) with a Handheld Transceiver

By Emily Clarke, W0EEC

**W**orking AO-51 and other FM satellites with a handheld transceiver is easy provided you follow some very simple suggestions. I'm not sure how I learned these techniques, but I've had many Elmers who have helped me along the way. These 12 suggestions should put you on the road to success and help you get farther.

- 1. THE MOST IMPORTANT RULE for HT success** (and even for FM base station users) is to keep your **SQUELCH OFF**. If you ignore every other rule in this list, don't ignore this one. Working satellites starts off as a process of finding weak signals, so don't expect the satellite to be nearly strong enough to break the squelch like your local repeater. I know it's noisy, but that's part of the process. Noise can also be an aid in locating the satellite because when the frequency starts to exhibit **QUIETING**, that's a sure sign that you are hearing the satellite, and you should get ready.
- 2. LISTEN FIRST!** Even though you only have 5 watts, it's still possible to jam other stations. Expect to hear other stations before you transmit. If you can't hear other stations and need to check your uplink, don't call CQ; just transmit your callsign. If others hear you, they will want to work you.
- 3. Use a good antenna for your HT.** A good gain whip antenna like the AL-800 is very good. Using an Arrow dual-band handheld antenna is better, and if you prefer to homebrew your antenna, Alex Diaz, XE1MEX, has an excellent Yagi-Uda design.
- 4. When you identify yourself, always say your CALLSIGN followed by "HANDHELD".** I've found most operators will give way to HT users if they identify themselves that way. "Portable" is also good.
- 5. Set up your radio so you can tune for DOPPLER.** If your HT only has 5KHz tuning steps, start listening 5 KHz above the center frequency - you will hear the satellite sooner and clearer. When you hear the downlink signals get scratchy or fuzzy, tune down 5KHz and it should be clearer. Follow the signal down in frequency as the pass continues. (See the graphic to the right.) If your HT doesn't allow you to use split frequencies in VFO mode, consider programming a couple



of memory channels in this way, then just move to the next memory channel. For 5KHz tuning step radios it's debatable whether or not tuning the transmit frequency is helpful. If you have 1KHz or finer tuning steps it definitely helps.

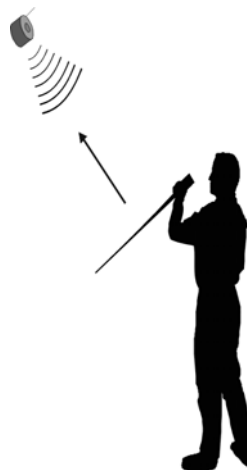
*Note: If you are working the ISS in voice repeater mode, you are working Mode B, so you need to tune your UPLINK (transmitter) for Doppler since the shift at 70cm is higher than the 2m uplink most FM satellites use.*

- 6. Don't hold your whip antenna upright.** Vertical antennas are not good and an HT held upright isn't either. The satellite isn't on the ground (which is what HT's and vertical antennas were designed for). **TILT IT** about the same amount as the **SATELLITES ELEVATION**. This means that if you are **FACING** the satellite, tilt it down towards the ground from **HORIZONTAL** an equal



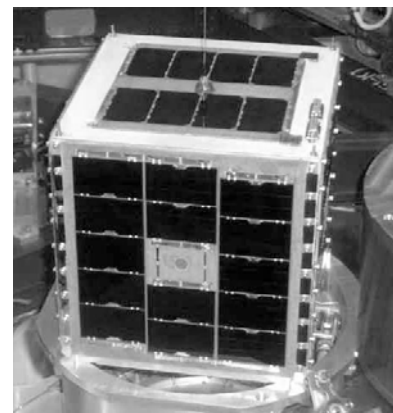
amount. If the satellite is to your back, tilt it up an equal amount away from the **SATELLITES** position off the vertical. You will be surprised at the difference.

- 7. Make sure you know where the satellite is.** Even



if you don't have a palm sized computer running a tracking program such as PocketSat or PetitTrack you can estimate this. If you know the AOS azimuth and the satellite pass time, you can just estimate how much to move until you find the satellite. On **ASCENDING** (South to North) with the satellite **EAST** of you or **DECENDING** passes (North to South) and **WEST** of you, move your body anti-clockwise (counter-clockwise for people in the US). If the satellite is **ASCENDING WEST** or **DECENDING EAST**, move clockwise.

- 8. HEADPHONES** are very important, especially if you are working full duplex. You are much better off listening with two ears than one. If you have a full duplex HT like an Icom IC-W32A, you can listen to your own downlink (a good thing). Your brain is far better at discriminating signals than most expensive DSPs.
- 9. Know your GRIDSQUARE** as that is a quick way of identifying your location. Saying CM87 is much quicker than saying "San Francisco, California". The ARRL and Icom have some dandy gridsquare maps the latter of which are free at most amateur radio stores. You can download both from the respective websites.
- 10. Map out a strategy for contacts.** This isn't rocket science, but close. So preparation and planning is important. Not every pass is workable with an HT, so don't go after the 10 degree passes. Pick your passes, and work the ones you know will give you the best chance. It's not a battleground out there but it's not a walk in the park either. You are competing with other stations for a limited resource



AO-51 ready for launch.





so it helps to plan. If there are population centers (bright spots on the map below) to the east of you, work western passes. If they are south of you, listen north. If you live on the coast, try passes out over the ocean.

11. If you don't plan to write down your contacts, try to work out some way to record them. You can hook an MP3 or Cassette recorder into the headphone jack on the receive side to record your contacts so you can review them later. On many HTs you can just use a simple "Y" cable available from Radio Shack. Even if you don't make contacts, it helps to accustom yourself to the callsigns, voices and personalities of the other operators. When I first started out I found it more valuable to know which contacts I missed rather than the ones I made.
12. Ask questions! Find an Elmer or look up the AMSAT area coordinator for your area. You can locate an Area Coordinator on the AMSAT Web site. Posting specific questions on the AMSAT bulletin board will also help you find answers.

And the most important suggestion of all - Join AMSAT! It will help you get plugged in to a very good organization, keep you informed of the latest developments, and contribute to the success of the amateur satellite program. 📡



Roxie Able, KC9CSV is interviewed by a newspaper reporter.

## Our ARISS Contact by Grant Zehr, AA9LC

The Prairie Aviation Museum in Bloomington, Illinois was chartered in 1983 and has grown steadily adding more displays and sponsoring flights and demonstrations with their restored DC-3 aircraft. The Museum, with community and grant support, has sponsored the development of the Challenger Learning Center of Central Illinois in Bloomington. A beautiful new facility has been built and an enthusiastic staff has been recruited. Educational activities are scheduled for school children during the school year and space camps are scheduled during the summer months. Simulated missions are an important part of the program at the Challenger Center. These take place in the "mission control" area and the "Spacecraft" area. The participants are divided into two smaller groups with half in Mission Control and half in the Spacecraft. Working together they try to complete the goals of the mission, solving problems as they arise. Some missions are designed for students and some are designed for adults. Local businesses can participate in missions and frequently use this activity as a "team building" exercise for their employee groups.

Our local radio club (Central Illinois Radio Club) was contacted by Janet Moore, the Flight Director at the Challenger Center, in the fall of 2003 to see if our club could help with an ARISS contact. Having more experience with satellites than most of the other club members, I agreed to help plan and prepare for a possible contact. Four members of the radio club did most of the preliminary work in preparation for our contact (myself, John Chubick, Ralph Bellas, and Gary Huber).

We completed the ARISS application form and in due course were notified that we were on the waiting list. After a couple of delays, due to a space walk and some other activities on the ISS, we received a contact time scheduled for August 16, 2004.

Our contact went very well. We were able to maintain a good radio link during the contact. Janet Moore from the Challenger Center did a very good job getting the students ready for the contact. The kids did well when they got their chance to ask their question.

All who were involved agreed that it was a great experience and we are hoping that we may get another chance to involve more students with another contact some time in the future.

At this time an audio recording of the contact

can be downloaded from the ARRL website at:

<http://www.arrl.org/news/stories/2004/08/19/3/?nc=1>

More pictures are available at the Challenger Center website:

<http://www.challengercentralillinois.org/> 📡



The contact is underway. Seated at the table from left to right are John Chubick, KB9LNS (hidden behind the monitor) at the tracking station, Grant Zehr, AA9LC at the control operator position, Roxie Able, KC9CSV with the microphone and Ralph Bellas, K9ZO at the backup station (behind the Prairie Aviation Museum sign). The students are in line to ask questions. Directly behind them (in the flight suit) is Janet Moore from the Challenger Center. Stacey Shrewsbury is on the cell phone in the left background with our ARISS advisor Charlie Sulfana, AJ9N.



The contact continues. Seated from left to right are Grant Zehr, AA9LC and Roxie Able, KC9CSV. Standing behind the student is Janet Moore, the teacher at the Challenger Learning Center (CLC). The students had all participated in summer space camp activities at the CLC.



Group picture. Back row from left to right are Roxie Able, KC9CSV, Grant Zehr, AA9LC, Ralph Bellas, K9ZO, and John Chubick, KB9LNS. The students, of course, are in front.

## Amateur Satellite Launch Sites

G. Gould Smith, WA4SXM, wa4sxm@amsat.org

The first amateur satellite was launched only four years after the first Man-made satellite achieved orbit. Since 1961 amateur satellite enthusiasts have continued to put new satellites into orbit to communicate, to experiment, to push the state of the art and to explore the higher frequencies. This is an international effort with numerous AMSAT organizations around the globe developing satellites and arranging for their launch. As you can see in Figure 1 the number of amateur satellites launched has increased over the last decade.

Vandenberg AFB was our first launch site and did a number of the early launches. As you can see below, sites in the former USSR have put a large number of our amateur satellites into orbit. Kourou has also been very active.

### Vandenberg AFB

Latitude: 34° 45' N, Longitude: 120° 37' W  
Minimum Inclination: 51.0°, Maximum Inclination: 145.0°

In December 1961 a Thor rocket launched a Discoverer 36 satellite and a small satellite

the Air Force identified a need for a secure launch site for missile tests and launches into polar orbit. In 1956 the DOD transferred the base to the Air Force and in 1958 the name changed to Vandenberg. The base became a center for research and launch activity to respond to the Russian launch of Sputnik. The first missile launch was a Thor IRBM in December of 1958. Two months later, Discoverer I was launched and became the world's first polar orbiting satellite. In 1995 Spaceport Systems International Commercial Spaceport leased 100 acres, including a space processing facility, from the Air Force to build a commercial launch facility.

Launch azimuth is constrained between 147 and 201 degrees, although sub-orbital launches are allowed up to 281 degrees. Satellite inclinations between 56 and 104 degrees are accomplished here. All US launches into polar orbits are done from Vandenberg.

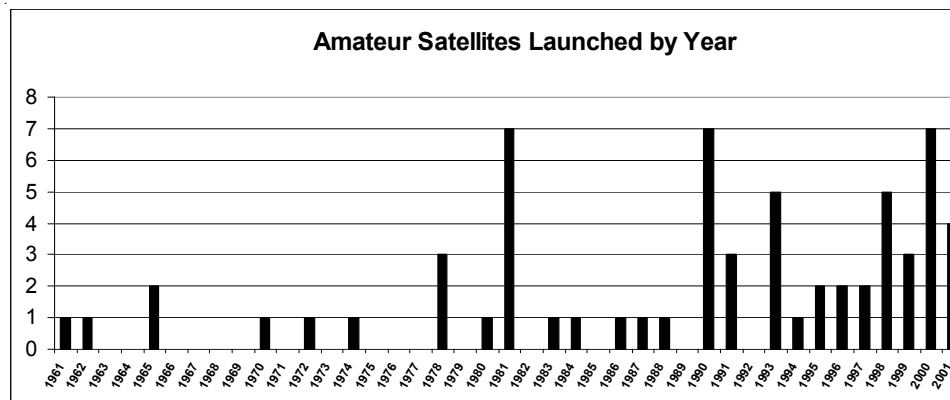
### Kourou (ESA)

Other names: Centre Spatial Guyanais  
Latitude: 5° 14' N, Longitude: 52° 45' W  
Minimum Inclination: 5.0 degrees, Maximum Inclination: 100.0 degrees

Kourou is the most active launch site in history and been very important to the amateur satellite community. Seventeen amateur satellites have been launched from Kourou, more than any other launch site.

France gave up their launch site in Algeria in the agreement for its independence. So a new launch site was needed. In 1966 ELDO chose Kourou in French Guiana for their Europa II launches and built a facility there. The Europa II launch complex was later renovated and converted for the Ariane launcher. In 1979 the first Ariane rocket was launched from Kourou. AMSAT International had their P3A satellite on one of the Ariane 1 test flights and saw a great deal of effort and expense end up on the floor of the Atlantic. Tom Clark, W3IWI, and a number of persevering leaders continued the vision and readied a second satellite (P3B) for launch three years later. AO-10 is still semi-operational. The Ariane 4x followed and has been an exceptionally successful launch vehicle for ESA (European Space Agency). The Ariane 4x program prospered and continued to increase its efficiency down to a 25-27 day launch timetable. Since the Ariane 4 vehicle is a three-stage rocket and each stage adds complexity and risk, Arianespace and ESA decided to build a larger lift capacity, two-

Figure 1. Amateur Satellites Launched by Year



Although AMSAT members are mainly concerned with designing, building, controlling and operating these satellites, it is important to understand how they get into orbit, how their orbit affects the satellite operations and how the launch site affects the orbit. This series is about "Rocket Science" but will explore these issues in an understandable fashion. There are three parts to the series: 1) launch sites; 2) orbital mechanics and 3) launch vehicles.

### Amateur Satellite Launch Sites

Over the 43-year history of amateur satellites all 71 amateur satellites have been launched from only eight different sites. Tables 1 – 8 list these launch sites and the amateur satellites launched from each one.

called OSCAR 1 built by a group of Amateur Radio operators. This satellite sent HI in CW at a rate proportional to the temperature of the satellite. This was the world's first operational amateur satellite. Most of the amateur satellites launched for the next twenty years were launched from Vandenberg. Amateur satellite launches returned to Vandenberg in 1999 after a fifteen-year absence. See Table 1 for a complete list of amateur satellite launches from Vandenberg.

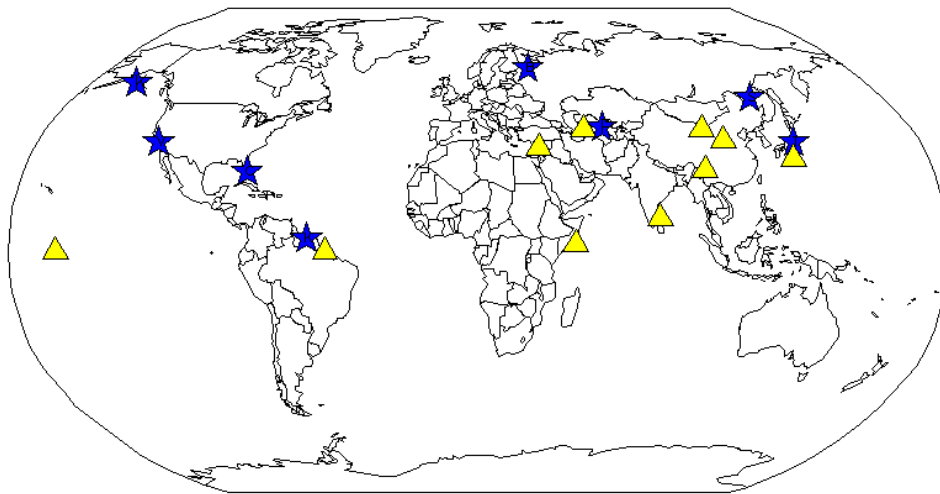
The United States Army purchased 86,000 acres of land in 1941 in a remote section of California 240 km NW of Los Angeles for Camp Cooke. The training camp for armored divisions was deactivated in 1953. In 1955

|                |                  |             |                                            |
|----------------|------------------|-------------|--------------------------------------------|
| Vandenberg     | 13 satellites in | 11 launches | 62, 62, 65, 70, 72, 74, 78, 81, 84, 99, 00 |
| Kourou         | 17 satellites in | 9 launches  | 80, 83, 88, 90, 91, 92, 93, 00, 02         |
| Cape Canaveral | 3 satellites in  | 3 launches  | 65, 98, 98                                 |
| Plesetsk       | 13 satellites in | 8 launches  | 78, 81, 87, 91, 91, 95, 96, 02             |
| Baikonur       | 14 satellites in | 9 launches  | 94, 97, 98, 98, 99, 99, 00, 01, 02         |
| Tanegashima    | 3 satellites in  | 3 launches  | 86, 90, 96                                 |
| Kodiak         | 3 satellites in  | 1 launch    | 01                                         |
| Svobodniy      | 1 satellite in   | 1 launch    | 7                                          |





Figure 2. Launch sites for all satellites. AMSAT launches are shown as stars.



stage rocket - the Ariane 5. This twelve-year development project was undertaken to make ESA competitive in the 21<sup>st</sup> century. It has been somewhat plagued with problems, but successfully launched P3D in 2000.

Because of its excellent location, launch azimuths from 11 to 90 degrees are over open ocean. Inclinations from 5.2° to 100.5° degrees are achievable. Additionally, Kourou's location close to the equator gives it an advantage for geosynchronous orbits. There have been talks for many years to build launch complexes for other launch vehicles at Kourou, but funding has been difficult to come by to complete the project.

### Cape Canaveral

Other names: Kennedy Space Center  
Latitude: 28° 28' N, Longitude: 80° 32' W  
Minimum Inclination: 28.0° Maximum Inclination: 57.0°

Cape Canaveral is America's largest launch center and used for all of the manned launches. In 1949 the Cape was selected and activated for rocket launches. It has since grown to house a large number of launch complexes. There are four launch groups there: Kennedy Space Center, used for Saturn V and Space Shuttle launches; Cape Canaveral, run by the DOD handling the other launches like the Delta; the commercial Spaceport Florida; and the air-launched vehicle Drop Zone.

Launch azimuth is constrained between 35 and 120 degrees due to land overflight restrictions. All launch inclinations are restricted to 28.5 and 59 degrees. This is the US launch site for equatorial launches (through orbit changes) and all manned missions.

### Plesetsk

Other names: GIK-1; GNIIP; Mirniy  
Latitude: 62° 54' N, Longitude: 40° 30' E

Plesetsk was the world's first operational ICBM base. It's very northern location put it closest to the continental US. Four large R-7 complexes were built in the late 1950's. The missiles were only armed once, during the Cuban missile crisis (September to November 1961). In 1962 Plesetsk was selected over Baikonour for space launches. The major flaw with Baikonour was that the technicians were housed 30 km away causing 3 to 4 hours of commute time for many vehicles. At Plesetsk the workers were housed in a planned city, Mirniy, just 1 to 2 km from the technical sites. At one time Plesetsk was the busiest launch center in the world. Since the breakup of the Soviet Union found Baikonur in Kazakhstan territory, it is thought that once the Proton rocket is retired, major operations will return to Plesetsk. Russia is planning to overcome the low net payload to geosynchronous orbit problem from Plesetsk by looping the satellites around the moon to get the necessary energy to change the orbit plane.

Launch azimuths from Plesetsk are constrained to narrow bands because of land overflight considerations. Launch inclinations are generally 62.8, 67.1, 73-74, and 82-83 degrees. Polar orbits can be obtained, but not retrograde. Soyuz (unmanned), Tsyklon F2, Zenit and Molniya rockets are launched from here, but there seems to be a shift of these launches to Tyuratam.

### Baikonur (Tyuratam)

Other names: GIK-5; NIIP-5; Tyuratam; Baykonur(Kazak); Leninsk  
Latitude: 46° 00' N, Longitude: 63° 00' E  
Minimum Inclination: 49.0°, Maximum Inclination: 99.9°

Tyuratam is Russia's largest cosmodrome and the site from which all manned and planetary missions originate. Tyuratam is actually in Kazakhstan but these republics have agreed to cooperate and jointly benefit from the launch complex. Tyuratam is the original site designation and the location from which Yuri Gagarin was launched into space in 1961. The story goes that to register the achievement with the International Aviation Federation the launch site must be named. Since this was during the cold war,

Table 1 Vandenberg AFB Amateur Satellite Launches

| OSCAR   | Name      | Launch Date<br>mm/dd/yyyy | Launch Vehicle     | Other Satellites                                                                        |
|---------|-----------|---------------------------|--------------------|-----------------------------------------------------------------------------------------|
| OSCAR 1 | OSCAR 3   | 12/12/1961                | Thor-DM21 Agena-B  | with KH-3 8 (Discoverer 36)                                                             |
| OSCAR 2 | OSCAR 3   | 6/2/1962                  | Thor-DM21 Agena-B  | with KH-4 5                                                                             |
| OSCAR 3 | OSCAR 3   | 3/9/1965                  | Thor-DSV2A Agena-D | with SECOR 3, Dodecapole 1, Solrad 6B, Solrad 7B, GGSE, GGSE 3, Surcal 4                |
| OSCAR 5 | Australis | 1/23/1970                 | Delta-N6           | with Tiros M                                                                            |
| AO 6    | AMSAT P2A | 10/15/1972                | Delta-300          | with NOAA 2                                                                             |
| AO 7    | AMSAT P2B | 11/15/1974                | Delta-2310         | with NOAA 4, Intasat                                                                    |
| AO 8    | AMSAT P2D | 3/5/1978                  | Delta-2910         | with Landsat 3, PIX 1                                                                   |
| UO9     | UoSat 1   | 10/6/1981                 | Delta-2310         | with SME                                                                                |
| UO-11   | UoSat 2   | 3/1/1984                  | Delta-3920         | with Landsat 5                                                                          |
| SO-35   | Sunsat    | 2/24/1999                 | Delta-7920-10      | with ARGOS, Orsted                                                                      |
| AO-37   | ASUSat 1  | 1/26/2000                 | Minotaur           | with JAWSAT, FalconSat 1, OCSE, OPAL, STENSAT, MEM 1A, MEMS 1B, Thelma, Louise, JAK     |
| OO-38   | OPAL      | 1/26/2000                 | Minotaur           | with JAWSAT, FalconSat 1, OCSE, ASUSat 1, STENSAT, MEM 1A, MEMS 1B, Thelma, Louise, JAK |
| WO-39   | JAWSAT    | 1/26/2000                 | Minotaur           | with ASUSat 1, FalconSat 1, OCSE, OPAL, STENSAT, MEM 1A, MEMS 1B, Thelma, Louise, JAK   |



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the Soviet policy was not to confirm the location of their missile sites. So to register the event, the Soviet's declared the launch site to be Baikonur, 300km NE of Tyuratam. This became the published location for many years and the name stuck.

This remote location was selected because the original R-7 rockets were controlled by three radio control stations arranged in a triangle 150-200km away from the launch site. The Kaputsin Yar site would require a station in the Caspian Sea or Iran, which was unacceptable. So a new location in an isolated site was chosen for security. The complex is extremely large, 85 km N to S by 125 km E to W. As internally guided rockets were developed building a new launch site in a more accessible area was

constantly discussed but the existing infrastructure made conversions to Baikonur more economical.

Numerous launch azimuths are possible from here, 65 degrees to -13 degrees, producing orbital inclinations between 50 - 99 degrees. Launches to the east are prohibited due to the likely impact of the stages on China. Most missions are typically 62.5-degree azimuth giving an inclination of 51.6 degrees. All Proton, Tsyklon F1 and Zenit rockets are launched from Baikonur.

In 1991 the US and Russia signed the Start Treaty that calls for the removal of nuclear missiles from their arsenals. The Russian SS-18 ICBM is the most powerful ICBM in the world and the Soviets decided that they would constructively dispose of them. ISC

(International Space Company) Kosmotras was established in 1997 for development and commercial operation of the Dnepr Space Launch System based upon the SS-18 ICBM technology. This is one of the largest conversion programs with 150 SS-18 missiles to be converted into commercial satellite launch vehicles. With the dissolving of the USSR, this venture has encouraged the cooperation of the Russian Federation, Ukraine and Republic of Kazakhstan. Twelve satellites have been launched to date with customers from UK, USA, Italy, Saudi Arabia, Malaysia and Germany. AMSAT-NA's Echo/AO-51 satellite was launched in June 2004 on the Dnepr rocket from Baikonur.



| Table 2 Kourou Amateur Satellite Launches |                    |                           |                  |                                                               |
|-------------------------------------------|--------------------|---------------------------|------------------|---------------------------------------------------------------|
| OSCAR                                     | Name               | Launch Date<br>mm/dd/yyyy | Launch Vehicle   | Other Satellites                                              |
| Failure                                   | AMSAT P3A          | 5/23/1980                 | Ariane-1         | with Firewheel, Firewheel Subsat 1,2,3,4; CAT 2               |
| AO-10                                     | AMSAT P3B          | 6/16/1983                 | Ariane-1         | with ECS 1                                                    |
| AO-13                                     | AMSAT P3C          | 6/15/1988                 | Ariane-44LP H10  | with Meteosat 3, PAS 1                                        |
| UO-14                                     | UoSat 3            | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 4, Webersat, DOVE, Pacsat, Lusat           |
| UO-15                                     | UoSat 4            | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 3, Webersat, DOVE, Pacsat, Lusat           |
| AO-16                                     | Pacsat             | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 4, Webersat, DOVE, UoSat 3, Lusat          |
| DO-17                                     | DOVE               | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 4, Webersat, Pacsat, UoSat 3, Lusat        |
| WO-18                                     | Webersat           | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 4, UoSat 3, DOVE, Pacsat, Lusat            |
| LO-19                                     | Lusat              | 1/22/1990                 | Ariane-40 H10    | with Spot 2, UoSat 4, Webersat, DOVE, Pacsat, UoSat 3         |
| UO-22                                     | UoSat 5            | 7/17/1991                 | Ariane-40 H10    | with ERS 1, Orbcomm X, SARA, Tubsat A                         |
| KO-23                                     | Kitsat 1           | 8/11/1992                 | Ariane-42P H10   | with TOPEX Poseidon, S-80/T                                   |
| AO-24                                     | Arsene             | 5/12/1993                 | Ariane-42L H10   | Astra 1C                                                      |
| KO-25                                     | Kitsat 2           | 9/26/1993                 | Ariane-40 H10    | with Spot 3, Stella, Healthsat 2, Eyesat 1, Itamsat, Posat 1  |
| IO-26                                     | Itamsat            | 9/26/1993                 | Ariane-40 H10    | with Spot 3, Stella, Healthsat 2, Eyesat 1, Kitsat 2, Posat 1 |
| AO-27                                     | Eyesat 1 (AMRAD )  | 9/26/1993                 | Ariane-40 H10    | with Spot 3, Stella, Healthsat 2, Kitsat 2, Itamsat, Posat 1  |
| PO-28                                     | Posat 1            | 9/26/1993                 | Ariane-40 H10    | with Spot 3, Stella, Healthsat 2, Eyesat 1, Itamsat, Kitsat 2 |
| AO-40                                     | AMSAT P3D          | 11/16/2000                | Ariane-5G        | with PAS 1R, STRV 1c, 1d                                      |
| BO-47/48                                  | Idefix (BreizhSAT) | 5/4/2002                  | Ariane-42P H10-3 | with Spot 5                                                   |

### Tanegashima Space Center

Latitude: 30° 24' N, Longitude: 130° 58' E  
Minimum Inclination: 28.5°, Maximum Inclination: 99.0°

Tanegashima is the main Japanese launch facility located on an island about 1000 km SW of Tokyo. Japan's large H2 and J1 vehicles are launched from here during a 'launch season' dictated by the local fishing season. All three of the JAMSAT amateur satellites have been launched from Tanegashima.

Launch azimuth is nearly unrestricted with

possible inclinations from 28.5 to 100 degrees.

### Kodiak

Latitude: 57° 26' N, Longitude: 152° 20' W

In January 1998 the Alaska Aerospace Development Corporation leased 1200 hectares of land on Kodiak Island to build a commercial spaceport. Kodiak Island is 400km south of Anchorage. The Island is advertised as an excellent location providing a wide range of launch azimuths into polar orbit. The facility can launch up to 3500kg into LEO or Molniya orbit. The weather is

surprisingly mild due to the warm Japanese currents and similar to the northwestern part of the US. It has an excellent port and rail facilities, making it a more favorable launch site than one would imagine. In 2001, the first Athena rocket launch carried three amateur satellites successfully into orbit.

### Svobodniy

Other names: GIK-2

Latitude: 51° 42' N, Longitude: 128° 00' E  
Minimum Inclination: 51.0°, Maximum Inclination: 110.0°

Following the breakup of the Soviet Union, Russia found Baikonur in Kazakhstan territory and Plesetsk without the facilities to launch large vehicles or place objects into low inclination orbits. So Russia decided to develop a new cosmodrome to give her a versatile launch port in her territory. Svobodniy, a decommissioned ICBM base located 8000 miles east of Moscow, was chosen in 1996 to be the new launch facility. A crash program was begun to build a facility that would handle both large and medium launch vehicles. Launch complexes for the Rokot and Start rockets were completed first and then the funding for the conversion dried up. Svobodniy can launch into polar orbit and to the ISS (International Space Station).

### Other Launch Sites

Currently there are less than two dozen active launch sites in the world. There are a dozen or more inactive sites that could be reactivated and converted, but this is an expensive proposition. There are also numerous companies and US states that have acquired space launch sites in various locations attempting to make a business of launching satellites, but these have not matured to date. There appears to be more capacity than major organizations willing to fund primary payloads. However, there are many groups and organizations wanting to participate as secondary payloads, which makes it more difficult for AMSAT, because we must to compete for these spots.

### Jiuquan

Latitude: 41.3° N, Longitude: 100.3° E  
Inclinations: 57 - 70°

China's first launch site, but lately has been inactive. It has been undergoing renovation to prepare it for manned launches. China became the third country to launch a man into space in October 2003.

### Sea Launch

Latitude: 0° N, Longitude: 154.0° W  
Inclinations: 0 - 100°

Long Beach, CA based multi-national corporation. They use a converted Norwegian oil platform to launch Russian

| Table 3 Cape Canaveral Amateur Satellite Launches |         |                           |                |                                    |
|---------------------------------------------------|---------|---------------------------|----------------|------------------------------------|
| OSCAR                                             | Name    | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites                   |
| OSCAR 4                                           | OSCAR 4 | 12/21/1965                | Titan-3C       | with LES 3, LES 4, OV2 3           |
| SO-33                                             | SEDSat  | 10/24/1998                | Delta-7326     | with DS1                           |
| PO-34                                             | PANSAT  | 10/29/1998                | Shuttle        | with Discovery F25, Spartan 201-F5 |





**Table 4 Plesetsk Amateur Satellites Launches**

| OSCAR       | Name                 | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites                      |
|-------------|----------------------|---------------------------|----------------|---------------------------------------|
| RS 1        | Radio Sport 1        | 10/26/1978                | Tsiklon-3      | with Kosmos 1045, RS 2                |
| RS 2        | Radio Sport 2        | 10/26/1978                | Tsiklon-3      | with Kosmos 1045, RS 1                |
| RS 3        | Radio Sport 3        | 12/17/1981                | Kosmos-3M      | with RS4, RS 5, RS 6, RS 7, RS 8      |
| RS 4        | Radio Sport 4        | 12/17/1981                | Kosmos-3M      | with RS3, RS 5, RS 6, RS 7, RS 8      |
| RS 5        | Radio Sport 5        | 12/17/1981                | Kosmos-3M      | with RS4, RS 3, RS 6, RS 7, RS 8      |
| RS 6        | Radio Sport 6        | 12/17/1981                | Kosmos-3M      | with RS4, RS 5, RS 3, RS 7, RS 8      |
| RS 7        | Radio Sport 7        | 12/17/1981                | Kosmos-3M      | with RS4, RS 5, RS 6, RS 3, RS 8      |
| RS 8        | Radio Sport 8        | 12/17/1981                | Kosmos-3M      | with RS4, RS 5, RS 6, RS 7, RS 3      |
| RS-10/11    | Radio Sport 10/11    | 6/23/1987                 | Kosmos-3M      | included in Kosmos 1861 (Tsikada #16) |
| AO-21/RS-14 | Informator 1         | 1/29/1991                 | Kosmos-3M      | included Informator 1                 |
| RS-12/13    | Radio Sport 12/13    | 2/5/1991                  | Kosmos-3M      | included in Kosmos 2123 (Tsikada #17) |
| failure     | Techsat 1 (Gurwin 1) | 3/28/1995                 | Start          | with EKA 2, Unamsat A                 |
| failure     | Unamsat A            | 3/28/1995                 | Start          | with EKA 2, Techsat 1                 |
| MO-30       | Unamsat B            | 9/5/1996                  | Kosmos-3M      | with Kosmos 2334 Parus #86)           |

**Table 6 Tanegashima Amateur Satellite Launches**

| OSCAR | Name             | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites  |
|-------|------------------|---------------------------|----------------|-------------------|
| FO-12 | JAS 1a (Fuji 1)  | 8/13/1986                 | H-1 (9 SO)     | with EGS, MABES   |
| FO-20 | JAS 1b (Fuji 1b) | 2/7/1990                  | H-1 (9 SO)     | with MOS 2, DEBUT |
| FO-29 | JAS 2 (Fuji 2)   | 8/17/1996                 | H-2            | with ADEOS 1      |

**Table 7 Kodiak Amateur Satellite Launches**

| OSCAR | Name        | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites                    |
|-------|-------------|---------------------------|----------------|-------------------------------------|
| SO-43 | Starshine 3 | 9/30/2001                 | Athena-1       | with PCSat, PICOSat, SAPPHIRE       |
| NO-44 | PCSat       | 9/30/2001                 | Athena-1       | with Starshine 3, PICOSat, SAPPHIRE |
| NO-45 | SAPPHIRE    | 9/30/2001                 | Athena-1       | with PCSat, PICOSat, Starshine 3    |

Zenit 3SL rockets. The platform is towed out to the equator for launches. You can watch the entire process on the Internet.

### Kagoshima

Latitude: 31.2° N, Longitude: 131.1° E  
Inclinations: 31 - 100°

Used for Japanese scientific missions. Launches the M-V vehicle.

### Kapustin Yar (Volograd)

Latitude: 48.6° N, Longitude: 46.3° E  
Inclinations: 51°

Russian launch site from 1961-1984 for satellite launches into 48-51° inclination orbit. Reactivated in 1999 for Kosmos 3M launches.

### Xichang

Latitude: 28.2° N, Longitude: 102.0° E  
Inclinations: 27.5 - 31.1°

Primary Chinese launch site for GTO payloads. Long March 2E, 3, 3A, 3B, and 3C vehicles.

### Taiyuan

Latitude: 38.7° N, Longitude: 111.5° E  
Inclinations: 87° and 96 - 98°

Launch site for smaller Chinese launches. Supports the LM-4 and LM-2C/SD vehicles.

### Sriharikota (Satish Dhawan Space Center)

Latitude: 13.9° N, Longitude: 80.4° E  
Inclinations: 18 - 50°, SSO with dogleg  
Indian space launch center for their PSLV and GSLV vehicles. Scheduled to launch India's first amateur satellite (VUSat) in the fall of 2004.

### Alcantara

Latitude: 2.3° N, Longitude: 44.4° W  
Inclinations: 2.2 - 100°

This is the Brazilian site that launches their VLS and VLM vehicles. They have been trying to establish a launch program for a number of years, but have been unsuccessful in launching a rocket; the latest failure was in late August 2003. There have been numerous discussions with other countries to launch their rocket here since this is a prime location, but to date none of these have worked out.

### Palmachim AFB

Latitude: 31.9° N, Longitude: 34.7° E  
Inclinations: 143°

The Israeli launch site for the Shavit 1 rocket. This must launch west over the Mediterranean to avoid overflying neighboring countries. Not a very active site.

### San Marco, Kenya

Latitude: 2.9° S, Longitude: 40.3° E  
Inclinations: 2.9 - 38°

This site is an Italian sea-based platform located near Kenya. Used to launch the US



Table 5 Baikonur/Tyuratam Amateur Satellite Launches

| OSCAR  | Name                     | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites                                                                           |
|--------|--------------------------|---------------------------|----------------|--------------------------------------------------------------------------------------------|
| RS-15  | Radio-ROSTO              | 12/26/1994                | Rokot-K        |                                                                                            |
| RS-17a | Sputnik 40               | 10/5/1997                 | Soyuz-U        | with Progress-M 36, Inspector 1, Sputnik 40-2                                              |
| RS-17b | Sputnik 40-2             | 10/5/1997                 | Soyuz-U        | with Progress-M 36, Inspector 1, Sputnik 40                                                |
| TO-31  | TMSat 1                  | 7/10/1998                 | Zenit-2        | with Resurs-01 2, Techsat 1B, FASat Bravo, Safir 2, WestPac                                |
| GO-32  | Tecsat 1B<br>(Gurwin 1B) | 7/10/1998                 | Zenit-2        | with Resurs-01 2, TMSat 1, FASat Bravo, Safir 2, WestPac                                   |
| RS-18  | Sputnik 41               | 10/25/1998                | Soyuz-U        | with Progress-M 40                                                                         |
| RS-19  | Sputnik 99               | 4/2/1999                  | Soyuz-U        | with Progress-M 41                                                                         |
| UO-36  | UoSat-12                 | 4/21/1999                 | Dnepr-1        |                                                                                            |
| SO-41  | Saudisat 1A              | 9/26/2000                 | Dnepr-1        | with Megsat 1, Unisat 1, Saudisat 1B, Tiungsat 1                                           |
| SO-42  | Saudisat 1B              | 9/26/2000                 | Dnepr-1        | with Megsat 1, Unisat 1, Saudisat 1A, Tiungsat 1                                           |
| MO-46  | Tiungsat 1               | 9/26/2000                 | Dnepr-1        | with Megsat 1, Unisat 1, Saudisat 1B, Saudisat 1A                                          |
| RS-21  | Kolibri 2000             | 11/26/2001                | Soyuz-FG       | with Progress-M1 7                                                                         |
| AO-49  | Safir-M<br>(AATIS Oscar) | 12/20/2002                | Dnepr-1        | included in Rubin 2; with Unisat 2, LatinSat 1, LatinSat 2, SaudiSat 1C, TrailBlazer-Dummy |
| SO-50  | SaudiSat 1C              | 12/20/2002                | Dnepr-1        | with Rubin 2, Unisat 2, LatinSat 1, LatinSat 2, TrailBlazer-Dummy                          |

built Scout until 1988. Now is launching the Start, Start 1 and Taurus rockets. Basically used to launch medium weight scientific payloads into LEO.

### Summary

- All 71 amateur satellites have been launched from only eight sites.
- There are less than two-dozen active satellite launch sites in the world.
- A number of countries have combined resources to build and launch rockets.

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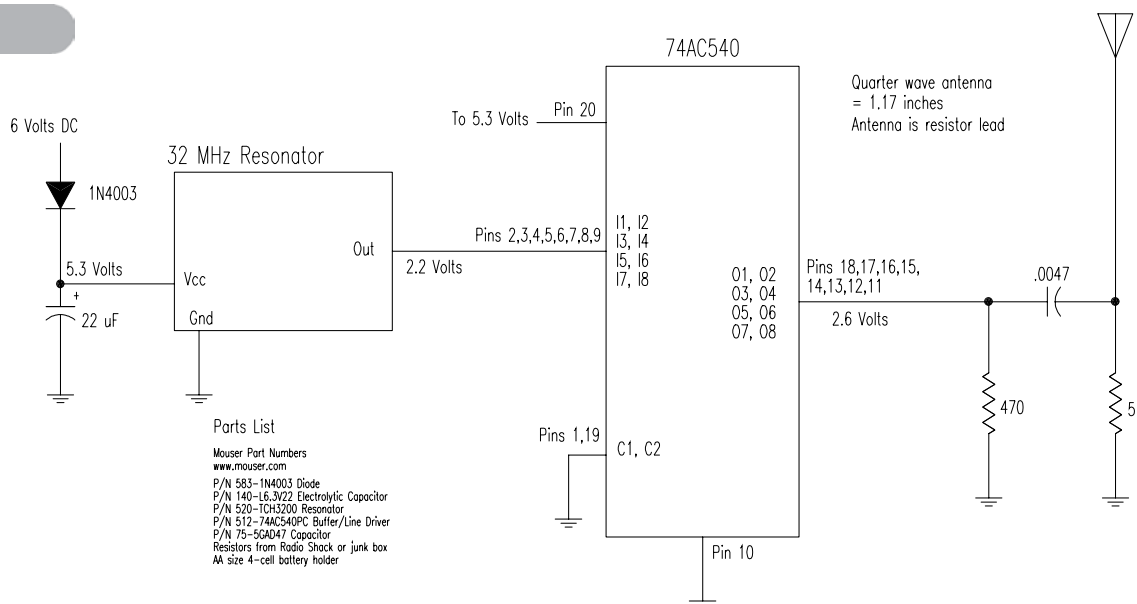
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Table 8 Svobodniy Amateur Satellite Launches

| OSCAR | Name | Launch Date<br>mm/dd/yyyy | Launch Vehicle | Other Satellites |
|-------|------|---------------------------|----------------|------------------|
| RS-16 | Zeya | 3/4/1997                  | Start-1.2      |                  |

## ERRATA

In the last issue of *The AMSAT Journal* the schematic for the 2400 MHz signal source was not very readable. Here is another version that we hope will be more readable. - Editor



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